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Volume 45/46

GASES IN MOLTEN SALTS

SOLUBILITY DATA SERIES

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A complete list of volumes published in the Solubility Data Series will be found on p. 555.

SOLUBILITY DATA SERIES

Volume 45/46

GASES IN MOLTEN SALTS

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FOREWORD

If the knowledge is
undigested or simply wrong,
more is not better.

The Solubility Data Series is a project of Commission V.8 (Solubility Data) of the International Union of Pure and Applied Chemistry (IUPAC). The project had its origins in 1973, when the analytical Chemistry Division of IUPAC set up a Subcommission on Solubility Data under the chairmanship of the late Prof. A.S. Kertes. When publication of the Solubility Data Series began in 1979, the Committee became a full commission of IUPAC, again under the chairmanship of Prof. Kertes, who also became *Editor-In-Chief* of the Series. The Series has as its goal the preparation of a comprehensive and critical compilation of data on solubilities in all physical systems, including gases, liquids and solids.

The motivation for the Series arose from the realization that, while solubility data are of importance in a wide range of fields in science and technology, the existing data had not been summarized in a form that was at the same time comprehensive and complete. Existing compilations of solubility data indeed existed, but they contained many errors, were in general uncritical, and were seriously out-of-date.

It was also realized that a new series of compilations of data gave educational opportunities, in that careful compilations of existing data could be used to demonstrate what constitutes data of high and lasting quality. As well, if the data were summarized in a sufficiently complete form, any individual could prepare his or her own evaluation, independently of the published evaluation. Thus, a special format was established for each volume, consisting of individual data sheets for each separate publication, and critical evaluations for each separate system, provided sufficient data from different sources were available for comparison. The compilations and, especially, the evaluations were to be prepared by active scientists who were either involved in producing new data, or were interested in using data of high quality. With minor modifications in format, this strategy has continued throughout the Series.

In the standard arrangement of each volume, the Critical Evaluation gives the following information:

(i) A text which discusses the numerical solubility information which has been abstracted from the primary sources in the form of compilation sheets. The text concerns primarily the quality of the data, after consideration of the purity of the materials and their characterization, the experimental method used, the uncertainties in the experimental values, the reproducibility, the agreement with accepted test values, and, finally, the fitting of the data to suitable functions, along with statistical tests of the fitted data.

(ii) A set of recommended data, whenever possible, including weighted averages and estimated standard deviations. If applicable, one or more smoothing equations which have been computed or verified by the evaluator are also given.

(iii) A graphical plot of the recommended data, in the form of phase diagrams where appropriate.

The Compilation part consists of data sheets which summarize the experimental data from the primary literature. Here much effort is put into obtaining complete coverage; many good data have appeared in publications from the late nineteenth and early twentieth centuries, or in obscure journals. Data of demonstrably low precision are not compiled, but are mentioned in the Critical Evaluation. Similarly, graphical data, given the uncertainty of accurate conversion to numerical values, are compiled only where no better data are available. The documentation of data of low precision can serve to alert researchers to areas where more work is needed.

A typical data sheet contains the following information:

- *(i)* list of components: names, formulas, Chemical Abstracts Registry Numbers;
- *(ii)* primary source of the data;
- *(iii)* experimental variables;
- *(iv)* compiler's name;
- *(v)* experimental values as they appear in the primary source, in modern units with explanations if appropriate;
- *(vi)* experimental methods used;
- *(vii)* apparatus and procedure used;
- *(viii)* source and purity of materials used;
- *(ix)* estimated error, either from the primary source or estimated by the compiler;
- *(x)* references relevant to the generation of the data cited in the primary source.

Each volume also contains a general introduction to the particular type of system, such as solubility of gases, of solids in liquids, etc., which contains a discussion of the nomenclature used, the principle of accurate determination of solubilities, and related thermodynamic principles. This general introduction is followed by a specific introduction to the subject matter of the volume itself.

The Series embodies a new approach to the presentation of numerical data, and the details continue to be influenced strongly by the perceived needs of prospective users. The approach used will, it is hoped, encourage attention to the quality of new published work, as authors become more aware that their work will attain permanence only if it meets the standards set out in these volumes. If the Series succeeds in this respect, even partially, the Solubility Data Commission will have justified the labour expended by many scientists throughout the world in its production.

January, 1989

J.W. Lorimer,
London, Canada

PREFACE

This volume in the Solubility Data Series contains tabulated collections and critical evaluations of original data for the solubility of gases in molten salts. Most of the solubilities were measured as a function of temperature above the melting point of the molten salt system. Some studies were made at different pressures. Where possible data are also reported in terms of a smoothing equation which represents the solubility or the Henry's law constant as a function of temperature. Heats of solution and entropies of solution are also reported where available.

Within the volume, material is arranged according to the individual gas. The gases include hydrogen halides, inert gases, oxygen, nitrogen, hydrogen, carbon dioxide, water vapor and halogens. The molten salt solvents consist of both single salts, binary mixtures and multicomponent systems. A special section on solubilities of gases in molten silicate systems is also included with the focus on slags and fluxes.

The data were gathered from a search of the chemical literature through the end of 1989, and make up a unique and valuable survey of the solubility of gases in molten salts.

The solubility of gases in molten salts has important implications in the various technological applications of molten salts. Some of these applications include high temperature molten salt batteries, extractive metallurgical processes such as the extraction of aluminum by electrolysis of fused chlorides, synthesis using molten salt systems, and energy storage in molten salts.

The editors would like to acknowledge the help and advice from several fellow members of the IUPAC commission on Solubility Data and in particular Professor Larry Clever (Emory University) and Dr. Peter Fogg (U.K).

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September 1990.

INTRODUCTION TO THE SOLUBILITY OF GASES IN MOLTEN SALTS

R. P. T. TOMKINS and N. P. BANSAL

INTRODUCTION

The Solubility Data Project aims to make a comprehensive search of the literature for data on the solubility of gases, liquids and solids in liquids. Data of suitable accuracy are compiled on data sheets set out in a uniform format. The data for each system are evaluated and where data of sufficient accuracy are available, recommended values are advanced and in some cases a smoothing equation suggested to represent the variation of solubility with pressure and/or temperature. A text giving an evaluation and recommended values and the compiled data sheets are published on consecutive pages.

DEFINITION OF GAS SOLUBILITY

The distinction between vapor-liquid equilibria and solubility of gases in liquids is arbitrary. It is generally accepted that the equilibrium set up at 300K between a typical gas such as argon and a liquid such as water is gas liquid solubility, where as the equilibrium set up between hexane and cyclohexane at 350K is an example of vapor-liquid equilibrium. However, the distinction between gas-liquid solubility and vapor-liquid equilibrium is often not so clear. The equilibria set up between methane and propane above the critical temperature of methane and below the critical temperature of propane may be classed as vapor-liquid equilibrium or as gas-liquid solubility depending on the particular range of pressure considered and the particular worker concerned.

The difficulty partly stems from our inability to rigorously distinguish between a gas, a vapor, and a liquid, which has been discussed in numerous textbooks. We have taken a fairly liberal view in these volumes and have included systems which may be regarded, by some workers, as vapor-liquid equilibria.

UNITS AND QUANTITIES

The solubility of gases in molten salts is of interest to a wide range of scientific and technological disciplines and not solely to chemistry. Therefore a variety of ways for reporting gas solubility have been used in the primary literature and inevitably sometimes, because of insufficient available information, it has been necessary to use several quantities in the compiled tables. Where possible, the gas solubilty has been quoted as a mole fraction of the gaseous component in the liquid phase. The units of pressure used are bar, pascal, millimeters of mercury and atmosphere. Temperatures are reported in kelvins. Heats of solution data are given in KJ mol^{-1}.

EVALUATION AND COMPILATION

The solubility of comparatively few systems is known with sufficient accuracy to enable a set of recommended values to be presented. This is true both for measurement near atmospheric pressure and at high pressures. Although a considerable number of systems have been studied by at least two workers, the range of pressures and/or temperatures is often sufficiently different to make meaningful comparison impossible.

Occasionally, it is not clear why two groups of workers obtained very different sets of results at the same temperature and pressure, although both sets of results were obtained by reliable methods and are internally consistent. In such cases, sometimes an incorrect assessment has been given.

There are several examples where two or more sets of data have been classified as tentative although the sets are mutually inconsistent.

PURITY OF MATERIALS

The purity of materials has been quoted in the compiled tables where given in the original publication. The solubility is usually more sensitive to impurities in the gaseous component than to liquid impurities in the liquid component. However, the most important impurities are traces of a gas dissolved in the liquid. Inadequate degassing of absorbing liquid is probably the most often overlooked serious source of error in gas solubility measurements.

APPARATUS AND PROCEDURES

In the compiled tables some key points are made of the apparatus and procedure. There are several reviews on experimental methods of determining gas solubilities in molten salts and these are given in references 1 - 16.

METHODS OF EXPRESSING GAS SOLUBILITIES

Because gas solubilities are important for many different scientific and engineering problems, they have been expressed in a great many ways:

The mole fraction, $x(g)$

The mole fraction solubility for a binary system is given by:

$$x(g) = \frac{n(g)}{n(g) + n(1)}$$

$$= \frac{W(g)/M(g)}{[W(g)/M(g)] + [W(1)/M(1)]}$$

where n is the number of moles of a substance (an amount of substance) W is the mass of a substance, and M is the molecular mass. To be unambiguous, the partial pressure of the gas (or the total pressure) and the temperature of measurement must be specified.

The Mass Per Cent Solubility, $100W$

For a binary system this is given by

$$\text{wt\%} = 100\ W(g)/[W(g) + W(1)]$$

where W is the weight of the substance. As in the case of mole fraction, the pressure (partial or total) and the temperature must be specified.

The Mass Solubility, C_w

The mass solubility is the number of moles of dissolved gas per unit mass of solvent when the partial pressure of gas is 1 atmosphere. The mass solubility is related to the mole fraction solubility at one atmosphere partial pressure by

$$x(g)\quad \text{(partial pressure 1 atm)} \quad \frac{C_W M(1)}{1 + C_W M(1)}$$

where M(1) is the molecular weight of the solvent.

The Amount concentration, n

Often for multicomponent systems the density of the liquid mixture is not known and the solubility is quoted as moles of gas per unit volume of liquid mixture. This is related to the mole fraction solubility by

$$x = \frac{n\ v^{o}(1)}{1 + n\ v^{o}(1)}$$

where $v^{o}(1)$ is the molar volume of the liquid component.

The Bunsen Coefficient, α

The Bunsen coefficient is defined as the volume of gas reduced to 273.15K and 1 atmosphere pressure which is absorbed by unit volume of solvent (at the temperature of measurement) under a partial pressure of 1 atmosphere. If ideal gas behaviour and Henry's law is assumed to be obeyed,

$$\alpha = \frac{V(g) \quad T_o}{V(1) \quad T}$$

where V(g) is the volume of gas absorbed and V(1) is the original (starting) volume of absorbing solvent and T_o = 273.15 K. The mole fraction solubility is related to the Bunsen coefficient by

$$x(g, 1\ \text{atm}) = \frac{\alpha}{\alpha + \dfrac{T_o \quad V^o(g)}{T \quad V^o(g)}}$$

where $v^o(g)$ and $v^o(1)$ are the molar volumes of gas and solvent at a pressure of one atmosphere. If the gas is ideal,

$$x(g) = \frac{\alpha}{\alpha + \dfrac{T_o}{V^o(1)}}$$

Real gases do not follow the ideal gas law and it is important to establish the real gas law used for calculating α in the original publication and to make the necessary adjustments when calculating the mole fraction solubility.

The Kuenen Coefficient, S

This is the unit mass of gas, reduced to 273.15 K and 1 atmosphere pressure, dissolved at a partial pressure of gas of 1 atmosphere by unit mass of solvent.

The Ostwald Coefficient, L

The Ostwald coefficient, L, is defined at the ratio of the volume of gas absorbed to the volume of the absorbing liquid, all measured at the same temperature:

$$L = \frac{V(g)}{V(1)}$$

If the gas is ideal and Henry's law is applicable, the Ostwald coefficient is independent of the partial pressure of the gas. It is necessary, in practice, to state the temperature and the total pressure for which the Ostwald coefficient is measured.

The mole fraction solubility, x, is related to the Ostwald coefficient by

$$x(g) = \left| \frac{RT}{p(g)\ L\ V^o(1)} + 1 \right|^{-1}$$

where P is the partial pressure of gas. The mole fraction solubility will be at a partial pressure of P(g).

The Absorption Coefficient, ß

There are several "absorption coefficients", the most commonly used one being defined as the volume of the gas, reduced to 273.15K and 1 atmosphere, absorbed per unit volume of the liquid when the total pressure is one atmosphere, ß is related to the Bunsen coefficient by

$$\beta = \alpha\,[1 - P(1)]$$

where P(1) is the partial pressure of the liquid in atmospheres.

The Henry's Law Constant

A generally used formulation of Henry's law may be expressed as

$$P(g) = K_H\,X(g)$$

where K_H is the Henry's law constant and x the mole fraction solubility. The other formulations are

$$P(g) = K_2 C(1) \quad \text{or} \quad C(g) = K_C C(1)$$

where K_2 and K_C are constants, C the concentration, and (1) and (g) refer to the liquid and the gas phases. Unfortunately, K_H, K_2, K_C are all sometimes referred to as Henry's Law constants. Henry's law is a limiting law but can sometimes be used for converting solubility data from the experimental pressure to a partial gas pressure of 1 atmosphere, provided the mole fraction of the gas in the liquid is small, and that the difference in pressures is small. Great caution must be exercised in using Henry's law.

The Mole Ratio, *N*

The mole ratio, N, is defined by $N = n(g)/n(1)$

Table 1 contains a presentation of the most commonly used interconversions not already discussed.

For gas solubilities greater than about 0.01 mole fraction at a partial pressure of 1 atmosphere there are several additional factors which must be taken into account to unambiguously report gas solubilities. Solution densitites or the partial molar volume of gases must be known. Corrections should be made for the possible non-ideality of the gas or the non-applicability of Henry's law.

Table 1. Interconversion of parameters used for reporting solubility.

$$L = \alpha(T/T_0), \quad T_0 = 273.15\ \text{K}$$

$$C_W = \alpha / V_o p$$

$$K_H/\text{mm Hg} = \frac{17.033 \times 10^6 p(\text{soln})}{\alpha\ M(1)} + 760$$

$$L = C_w\, V_{t,gas} p$$

where v_o is the molal volume of the gas in $cm^{-3}mol^{-1}$ at 0°C, p the density of the solvent at the temperature of the measurement, p_{soln} the density of the solution at the tempertature of the measurement, and $V_{t,gas}$ the molar volume of the gas at the temperature of the measurement.

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COMPONENTS: (1) Helium; He; [7440-59-7] (2) Lithium nitrate; $LiNO_3$; [7790-69-4]	ORIGINAL MEASUREMENTS: Cleaver, B.; Mather, D. E. **Trans. Faraday Soc.** <u>1970</u>, **66**, 2469 - 82.
VARIABLES: T/K = 543 P/kPa = 25000 - 10^5	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of helium in the melt at only one temperature, 270°C, are presented in graphical form as a function of the gas pressure in the range 250 - 1000 bar. The value of Henry's law constant, K_H, is:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
270	1.51 ± 0.4

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: High pressure elution method. Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A sample of the saturated melt was isolated and analyzed by the elution technique.	SOURCE AND PURITY OF MATERIALS: Helium (99.8%) was used as received from the British Oxygen Company without further purification or drying. $LiNO_3$ (99.9%) obtained from Johnson Matthey & Co.was recrystallized from distilled water and dried at 120°C. It was stored in an oven at 100°C.
	ESTIMATED ERROR: δP/bar = ± 10
	REFERENCES:

COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

EVALUATOR:

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National Aeronautics and Space Administration.
Lewis Research Center.
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Only three studies (1 - 3) have been reported for the solubility of helium in molten sodium nitrate. Smoothed data from these studies, at different temperatures, are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}		
T/K	Field & Green (1)	Cleaver & Mather (2)	Copeland & Zybko (3)
590	0.87	(1.75)	
600	0.91	(1.83)	
620	0.99	1.99	
640	1.07	2.17	22.7[a]
660	1.16	2.34	
680	(1.25)	2.51	
700	(1.33)	2.69	

[a] At 642 K
Values in ( ) outside temperature interval of experimental measurement.

Copeland and Christie (4) have pointed out that solubility results reported earlier from their laboratory are not reliable. Therefore, the results of Copeland and Zybko (3) are rejected.

Solubility values of Cleaver and Mather (2) are two times larger than those of Field and Green. Although the heats of solution reported by the two groups are in excellent agreement, the entropy values are different. This is because the disagreement between the results lies in the magnitude rather than in the temperature dependence of the solubility.

Additional studies are required in order to evaluate and to advance recommended values for this system.

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COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Field, P. E.; Green, W. J.
J. Phys. Chem. 1971, **75**, 821 - 25.

Green, W. J. **Ph.D. Thesis**, Virginia Polytechnic Institute 1969.

VARIABLES:

$T/K = 588 - 675$

$P/kPa = 126.656 - 130.709$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law is obeyed over the pressure range studied (1.25 - 1.29 atm). The values of Henry's law constant, K_H, for the solubility of He in molten $NaNO_3$ at different temperatures are:

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
588	0.856
618	0.980
643	1.068
675	1.223

Smoothed Data:

The temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = (-5.87 \pm 0.06) - (703.60 \pm 0.04)/(T/K)$$

std. dev. = 0.32%

The enthalpy of solution, ΔH, and the entropy of solution, ΔS, are:

$$\Delta H/\text{kcal mol}^{-1} = 3.22 \pm 0.18$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -5.28 \pm 0.29 \qquad \text{(at 637 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram of the gas solubility apparatus is given in the original publication.

The experimental process consisted of three steps: saturation, elution and analysis. After saturating the melt with He gas, the gas phase was evacuated. Argon was introduced into the system as eluting gas to approx. 1 atm. pressure. The resultant gas mixture was analyzed with an Aerograph Model 90 - P gas chromatograph (Varian). The carrier gas used was also argon. Average of four measurements was used for calculation of the gas solubility.

SOURCE AND PURITY OF MATERIALS:

Helium and argon obtained from Airco were used directly from the cylinder.

Baker's reagent grade sodium nitrate was used without further purification.

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Cleaver, B.; Mather, D. E.

Trans. Faraday Soc. 1970, **66**, 2469 - 82.

VARIABLES:

$T/K = 605 - 714$

$P/kPa = 11000 - 10^5$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of helium in the melt at three temperatures are presented only in the graphical form as a function of the gas pressure in the range 110 - 1000 bar. Values of Henry's law constant, K_H are:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
332	1.86 ± 0.3
391	2.32 ± 0.3
441	2.80 ± 0.3

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\text{ bar}^{-1}) = -5.574 - 701.4/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.6\% \quad \text{(compiler)}$$

$$\Delta H/\text{kJ mol}^{-1} = 13.4$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -17.4$$

ΔH is the enthalpy of solution, and $\Delta S°$ is the standard entropy of solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A portion of the saturated melt was isolated and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Helium (99.8%) was used as received from British Oxygen Company without further purification or drying.

Sodium nitrate (> 99.5%) A. R. grade from B. D. H. was purified by filtration through Pyrex frits in the molten state. The melt was allowed to freeze and stored **in vacuo**.

ESTIMATED ERROR:

$\delta P/bar = \pm 10$

REFERENCES:

COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Zybko, W. C.

J. Phys. Chem. 1966, 70, 181 - 86.

VARIABLES:
P/kPa = 11145.75 - 32525.33
one temperature: T/K = 642

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of helium in molten sodium nitrate at 369°C was determined up to a saturating gas pressure of 321 atm. Henry's law was obeyed. The value of Henry's law constant, K_H, is given as:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
369	22.7 ± 0.7

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method used for the gas solubility measurements in the melt was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Helium (99.99%) from the National Gas Co. was used.

Reagent grade sodium nitrate from Baker and Adamson was used without further purification other than drying.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Copeland, J. L.; Zybko, W. C. **J. Phys. Chem.** 1965, 69, 3631.

COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Silver nitrate; $AgNO_3$; [7761-88-8]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Radak, S.

J. Phys. Chem. 1967, 71, 4360 - 65.

VARIABLES:

P/kPa = 5167.58 - 25027.28
one temperature: T/K = 523

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of helium in molten silver nitrate at 250°C was determined upto a saturating gas pressure of 247 atm. Henry's law was obeyed. The value of Henry's law constant, K_H, is given as:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
250	3.57 ± 0.48

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment and technique used for gas solubility were exactly the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Helium (99.98%) gas from National Cylinder Gas Co. was used.

Reagent grade silver nitrate obtained from Mallinckrodt, Fisher Scientific and Baker were used. Before each measurement, silver nitrate was fused, allowed to cool and solidify in a porcelain casserole placed in a desiccator and then finely pulverized.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Copeland, J. L.; Zybko, W. C.

J. Phys. Chem. 1965, 69, 3631.

COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Dilithium beryllium fluoride; Li_2BeF_4

ORIGINAL MEASUREMENTS:

Malinauskas, A. P.; Richardson, D. M.

Ind. Eng. Chem. Fundam. 1974, 13, 242 - 45.

VARIABLES:

T/K = 773 - 1073
P/kPa = 101.325 - 202.650

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, and the Ostwald coefficient, L, for the solubility of helium in molten Li_2BeF_4 at various temperatures are:

T/K	10^8 K_H^a/mol cm^{-3} atm^{-1}	10^3 L
773	6.08 ± 0.39	3.86 ± 0.25
873	8.38 ± 0.15	6.01 ± 0.11
973	11.47 ± 0.23	9.16 ± 0.18
1073	16.47 ± 0.25	14.51 ± 0.22

[a] Calculated by the compiler using the relation $K_H = L/RT$.

Smoothed Data:
Temperature dependence of K_H and L are expressed by the relations:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.7095 - 1177/(T/K)$$

$$\log L = \log(T/K) - 1177/(T/K) - 3.7954$$

The enthalpy of solution, ΔH, and the standard entropy of solution, ΔS°, are:

$$\Delta H/\text{kcal mol}^{-1} = 5.39 \pm 0.49$$

$$\Delta S°/\text{eu} = -3.6 \pm 0.6 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The diagram and details of the apparatus used and the experimental procedure followed have been described earlier (1). In brief, the melt was saturated with helium and a known volume of the saturated solution was transferred to the stripper. The dissolved helium was freed by flushing with xenon and analyzed by mass spectroscopy.

SOURCE AND PURITY OF MATERIALS:

Helium and xenon were 99.9% pure. Helium gas was purified by passing through liquid nitrogen cooled coils of copper tubing.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Malinauskas, A. P.; Richardson, D. M.; Savalainen, J. E.; Shaffer, J. H. **Ind. Eng. Chem. Fundam.** 1972, 11, 584.

COMPONENTS:

(1) Helium; He; [7440-59-7]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1972, 68, 2083 - 89.

VARIABLES:

$T/K = 508 - 603$
$P/kPa = 10^2$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solvent used was an equimolar molten mixture of sodium and potassium nitrates. The solubilities of helium in the melt at four temperatures are:

T/K	10^8 K_H/mol cm^{-3} bar^{-1}
508	2.9
533	3.5
573	4.5
603	5.4

Smoothed Data:

The temperature dependence of Henry's law constant, K_H, is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ bar}^{-1}) = -5.834 - 865.7/(T/K) \qquad \text{(compiler)}$$

std. dev. = 0.25% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are;

$$\Delta H/\text{kJ mol}^{-1} = 16.5$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -23 \qquad \text{(at 533 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The details of the apparatus and procedure employed for solubility measurements are described elsewhere (1). Briefly, the melt was vacuum degassed degassed for a long time. The vacuum was disconnected and helium gas was introduced at about one bar pressure. The melt was vigorously stirred; pressure variations were noted with a manometer with time until the equilibrium was attained. The amount of gas dissolved was calculated from the final pressure variation after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

Helium (High Purity grade) was purified by keeping in contact with Ascarite. for several hours to remove CO_2 and other acidic impurities and molecular sieve 5A at - 80°C to remove water impurities.

Reagent grade sodium and potassium nitrates were used to prepare the solvent which was filtered in the molten state.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.

J. Electroanal. Chem. 1972, 38, 373.

COMPONENTS:

(1) Helium; He; [7440-59-7]

(2) Lithium fluoride; LiF; [7789-24-4]

(3) Beryllium fluoride; BeF_2; [7789-49-7]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration.
Lewis Research Center
Cleveland, Ohio, 44135. U.S.A.
December, 1989.

CRITICAL EVALUATION:

Three experimental studies are available for the solubility of helium in molten lithium fluoride - beryllium fluoride mixture. One of these studies (1) reported only a single data point at one temperature and this has been included in the later study (2) by the same workers. Values of the Henry's law constant are compared below at different temperatures along with the thermodynamic parameters:

	10^8 K_H/mol cm^{-3} atm^{-1}	
T/K	Malinauskas et al. (1,2)	Watson et al. (3)
773	6.08 ± 0.39	7.49 ± 0.07
873	8.38 ± 0.15	11.55 ± 0.39
973	11.47 ± 0.23	14.93 ± 0.42
1073	16.47 ± 0.25	19.48 ± 0.01
ΔH/kJ mol^{-1}	22.55 ± 2.05	21.76
ΔS/J K^{-1} mol^{-1} (at 1000 K)	-15.06 ± 2.5	-14.2

The values of enthalpy of solution and entropy of solution reported by the two groups are in very good agreement, within experimental error. However, the solubility data of Watson et al. are 25 - 30% higher than those of Malinauskas et al.

Tentatively, the solubility values may be taken as the average of the two data sets. However, additional study is required in order to advance recommended values.

References:

1. Malinauskas, A. P.; Richardson, D. M.; Savolainen, J. E. Shaffer, J. H. **Ind. Eng. Chem. Fundam.** 1972, 11, 584.

2. Malinauskas, A. P.; Richardson, D. M. **Ind. Eng. Chem. Fundam.** 1974, 13, 242.

3. Watson, G. M.; Evans III, R. B.; Grimes, W. R.; Smith, N. V. **J. Chem Eng. Data** 1962, 7, 285.

COMPONENTS: (1) Helium; He; [7440-59-7] (2) Lithium fluoride; LiF; [7789-24-4] (3) Beryllium fluoride; BeF_2; [7789-49-7]	**ORIGINAL MEASUREMENTS:** Malinauskas, A. P.; Richardson, D. M. Savolainen, J. E.; Shaffer, J. H. **Ind. Eng. Chem. Fundam.** 1972, 11, 584 - 86.
VARIABLES: one temperature: $T/K = 873$ $P/kPa = 101.325 - 202.650$	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The value of Henry's law constant, K_H, for the solubility of helium in the molten LiF - BeF_2 eutectic is:

$t/°C$	$10^8\ K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}$
600	8.40 ± 0.16

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The diagram and details of the apparatus used and procedure followed are given in the original paper. In brief, the apparatus consisted of two parts, the saturation chamber and the stripper chamber. The main parts of the apparatus were constructed of Hastelloy, a nickel based alloy containg 7% Cr, 4% Fe, 12 -17% Mo.

In an experiment, the melt in the saturation chamber was saturated with helium. A known amount of the saturated solution was transferred into the stripping chamber where the dissolved gas was stripped from the solvent and collected for measurement.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Helium; He; [7440-59-7]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Watson, G. M.; Evans III, R. B.; Grimes, W. R.; Smith, N. V.

J. Chem. Eng. Data 1962, 7, 285 - 87.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 773 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of helium in the melt LiF - BeF_2 (64 - 36 mol%) at different temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
500	7.49 ± 0.07
600	11.55 ± 0.39
700	14.93 ± 0.42
800	19.48 ± 0.01

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.656 - 1131.4/(T/K) \qquad \text{(compiler)}$$

std. dev. = 1.2% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = 5.2$$

$$\Delta S°/\text{cal K}^{-1}\ \text{mol}^{-1} = -3.4 \qquad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping or elution method.

The apparatus and procedure used for the gas solubility measurements were the same as described elsewhere (1,2).

SOURCE AND PURITY OF MATERIALS:

Helium gas, (> 99.9%) was obtained in cylinders from the Bureau of Mines, Amarillo, Texas.
LiF was of reagent grade. BeF_2 (99.5% ± 0.05%) used was obtained from the Beryllium Corp. of America.
The molten solvent was prepared by mixing the two fluorides in proper proportions and purified by flushing at 800°C alternately with anhydrous HF and H_2

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, **62**, 862.
2. Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M.
Ibid. 1959, **63**, 1164.

COMPONENTS:

(1) Helium; He; [7440-59-7]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Ward, W. T.; Watson, G. M.; Evans, R. B.; Grimes, W. R.

U.S.A.E.C. Rept. O.R.N.L. - 2931
1960, 29 - 31.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 773 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of helium in the melt NaF - BeF_2 (57 - 43 mol%) at different temperatures are:

t/°C	$10^7\ K_H{}^*/\text{mol cm}^{-3}\ \text{atm}^{-1}$
500	1.29
600	1.77
650	1.97
700	2.22
800	2.88

* Values read from the graph by the compiler.

Smoothed Data:

Temperature dependence of K_H can be expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.671 - 946.4/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.1\% \quad \text{(compiler)}$$

The heat of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = 4.3 \quad \text{(compiler)}$$

$$\Delta S°/\text{cal K}^{-1}\ \text{mol}^{-1} = -3.2 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The method used for the determination of gas solubilities in the molten salt solvent was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Helium; He; [7440-59-7]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862 - 66.

VARIABLES:

P/kPa = 50.663 - 202.650
T/K = 873 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of He in the melt NaF - ZrF_4 (53 - 47 mol%) at three temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	21.6 ± 1.0
700	29.2 ± 0.7
800	42.0 ± 1.3

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.135 - 1344/(T/K) \qquad \text{(compiler)}$$

$$\text{std. dev.} = 2.3\% \qquad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the entropy of dissolving the gas, ΔS, with equal concentrations in the gaseous and liquid states, are:

$$\Delta H/\text{kcal mol}^{-1} = 6.2$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -1.0 \qquad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus and procedure are described in detail in the original paper. In brief, the melt was saturated with helium by sparging it with the gas for 6 hours at the desired pressure. Part of the molten salt solution was allowed to transfer into the stripping section. The dissolved helium was stripped from the melt by circulation of argon through the system for about 15 minutes. The amount of helium present in the eluted gas mixture was determined by mass spectrometry.

SOURCE AND PURITY OF MATERIALS:

Helium gas, (>99.9%) was obtained from the Bureau of Mines at Amarillo, Texas. Reagent grade Sodium fluoride was obtained from Mallinckrodt Chemical Co. ZrF_4 was prepared by hydrofluorination at 500°C in nickel equipment. The melt was prepared by mixing the two components in proper amounts and purified at 800°C by sparging it alternatively with anhydrous HF and H_2. No oxide was present in the melt.

ESTIMATED ERROR:

solubility = ± 10% (author)

REFERENCES:

COMPONENTS:

(1) Helium; He; [7440-59-7]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Sodium fluoride; NaF; [7681-49-4]
(4) Potassium fluoride; KF; [7789-23-3]

ORIGINAL MEASUREMENTS:

Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1959, 63, 1164 - 67.

VARIABLES:

T/K = 873 - 1073
P/kPa = 121.59

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of helium in the melt LiF - NaF - KF (46.5 - 11.5 - 42.0 mol%) at different temperatures, and pressures ranging from 1 - 2 atm, are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	11.3 ± 0.7
650	13.7
700	17.5 ± 0.2
800	23.0 ± 0.7

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.261 - 1470.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.4% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = 8.0$$

$$\Delta S°/\text{cal K}^{-1}\text{ mol}^{-1} = -0.3 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping or elution method.

The details of the apparatus and procedure used have been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Helium gas, purity better than 99.9%, was obtained from the Bureau of Mines at Amarillo, Texas.

The melt was prepared by mixing Reagent grade LiF, NaF and KF in proper proportions. The melt was purified at 800°C by flushing it alternately with anhydrous HF and H_2. Nickel apparatus was used.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

   J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Helium; He; [7440-59-7]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]
(4) Uranium tetrafluoride; UF_4; [10049-14-6]

ORIGINAL MEASUREMENTS:

Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958,62, 862 - 66.

VARIABLES:

$T/K = 873 - 1073$
$P/kPa = 50.663 - 202.650$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of helium in the melt NaF - ZrF_4 - UF_4 (50 - 46 - 4 mol%) at different temperatures, and pressures ranging from 1 - 2 atm, are:

$t/°C$	$10^8\ K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}$
600	20
700	27
800	41

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.054 - 1447/(T/K)$$ (compiler)

std. dev. = 3.4% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 27.7$$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus and procedure employed are described in detail in the original paper. In brief, the melt was saturated with helium by sparging it with the gas for 6 hours at the desired gas pressure. Part of the molten salt solution was transferred into the stripping section. The dissolved helium was stripped from the melt by circulation of argon through the system for about 15 minutes. The amount of helium present in the eluted gas mixture was obtained by mass spectrometry.

SOURCE AND PURITY OF MATERIALS:

Helium gas, (>99.9%) was obtained from the Bureau of Mines at Amarillo, Texas.

Reagent grade NaF and UF_4 were obtained from the Mallinckrodt Chemical Co. ZrF_4 was prepared by hydrofluorination of $ZrCl_4$ at 773K in nickel equipment. The melt was prepared by mixing the three fluorides in proper ratio and purified at 800°C by sparging it alternatively with anhydrous HF and H_2. No oxide was present in the melt.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Neon; Ne; [7440-01-9]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Watson, G. M.; Evans III, R. B.; Grimes, W. R.; Smith, N. V.

J. Chem. Eng. Data 1962, 7, 285 - 87.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 773 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The Henry's law constant, K_H, for the solubility of neon in the melt LiF - BeF_2 (64 - 36 mol%) at different temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
500	3.09 ± 0.09
600	4.63 ± 0.01
700	6.80 ± 0.09
800	9.01 ± 0.15

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.839 - 1295.8/(T/\text{K}) \quad \text{(compiler)}$$

std. dev. = 0.9% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = 5.9$$

$$\Delta S°/\text{cal K}^{-1}\text{ mol}^{-1} = -4.2 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping or elution method.

The apparatus and procedure used for gas solubility measurements have been described elsewhere (1,2).

SOURCE AND PURITY OF MATERIALS:

Neon gas, (>99.9%) was obtained from the Linde Co.

LiF was of reagent grade. BeF_2 (99.5 ± 0.5%) was obtained from the Beryllium Corp. of America.

The melt was prepared by mixing the two fluorides in proper proportions. The melt was purified by sparging it alternately with anhydrous HF and H_2 at 800°C.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M. **J. Phys. Chem.** 1958, **62**, 862.
2. Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M. **Ibid.** 1959, **63**, 1164.

COMPONENTS:

(1) Neon; Ne; [7440-01-9]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862 - 66.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 873 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of neon in the melt NaF - ZrF_4 (53 - 47 mol%) at three temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	11.3 ± 0.3
700	18.4 ± 0.5
800	24.7 ± 0.7

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.109 - 1598.5/(T/K) \qquad \text{(compiler)}$$

std. dev. = 2% (compiler)

The enthalpy of solution, ΔH, and the entropy, ΔS, of dissolving the gas with equal concentrations in the gaseous and liquid states are:

$$\Delta H/\text{kcal mol}^{-1} = 7.8$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -0.4 \qquad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution stripping method.

The diagram and details of the apparatus and procedure are described in detail in the original paper. Briefly, the melt was saturated with neon by sparging it with the gas for 6 hours at the desired gas pressure. Part of the molten salt solution was transferred into the stripping section. The dissolved neon was stripped from the melt by circulation of helium through the system for about 15 minutes. The amount of neon present in the eluted gas mixture was determined by mass spectrometry.

SOURCE AND PURITY OF MATERIALS:

Neon gas, (>99.9%), was obtained from Linde Air Products Co.
Sodium fluoride of Reagent grade was obtained from Mallinckrodt.
ZrF_4 was prepared by hydrofluorination of $ZrCl_4$ at 500°C in nickel apparatus. The melt was prepared by mixing the two salts in proper proportion and purified at 800°C by sparging it alternately with anhydrous HF and H_2.
No oxide was present in the melt.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Neon; Ne; [7440-01-9]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Sodium fluoride; NaF; [7681-49-4]
(4) Potassium fluoride; KF; [7789-23-3]

ORIGINAL MEASUREMENTS:

Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1959, 63, 1164 - 67.

VARIABLES:

$T/K = 873 - 1073$
$P/kPa = 101.325 - 202.650$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of Neon in the molten salt solvent LiF - NaF - KF eutectic (46.5 - 11.5 - 42.0 mol%) at different temperatures, and the pressures ranging from 1 - 2 atm, are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	4.36 ± 0.20
700	7.51 ± 0.22
800	11.18 ± 0.26

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.158 - 1920/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.9\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, ΔS°, are:

$$\Delta H/\text{kcal mol}^{-1} = 8.9$$

$$\Delta S°/\text{cal K}^{-1}\text{ mol}^{-1} = -0.1 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping or elution method.

The apparatus and procedure employed have been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Neon gas, purity better than 99.9%, was obtained from Linde Air Products Company.

The melt was prepared by mixing Reagent grade LiF, NaF and KF in the proper ratio. The melt was purifed at 800°C by flushing it alternately with anhydrous HF and H_2. Nickel apparatus was used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Green, W. J. **Ph.D. Thesis**, Virginia Polytechnic Institute <u>1969</u>.

Green, W. J.; Field, P. E.
J. Phys. Chem. <u>1980</u>, **84**, 3111 - 3114.

VARIABLES:

T/K = 531 - 595
P/kPa = 50.663 - 151.988

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of Ar in molten $LiNO_3$, at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
531	0.74
534	0.94
540	1.01
546	0.65
549	1.12
553	1.06
562	1.43
563	1.45
564	1.46
574	1.56
581	1.62
595	1.71

Smoothed Data:

The temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -3.77 - 1748.9/(T/K)$$

std. dev. = 1.2%   (compiler)

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$\Delta H/\text{kcal mol}^{-1} = 8.0 \pm 0.89$

$\Delta S/\text{cal K}^{-1}\text{ mol}^{-1} = 4.16 \pm 1.60$ (at 581 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the gas solubility apparatus are given in the original publication.

The experimental process consisted of three steps: saturation, elution and analysis. After saturating the melt with argon, the gas phase was evacuated. Helium gas was introduced into the system as eluting gas to approximately 1 atm. pressure. The resultant gas mixture of argon and helium was analyzed with Aerograph Model 90 - P gas chromatograph (Varian). The carrier gas used was also helium.

SOURCE AND PURITY OF MATERIALS:

Argon and helium obtained from Airco were used directly from the cylinder.

Reagent grade lithium nitrate from Baker was used without further purification.

ESTIMATED ERROR:

$\delta C/P = \pm$ 5%   (authors)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Cleaver, B.; Mather, D. E.

Trans. Faraday Soc. 1970, 66, 2469 - 82.

VARIABLES:

T/K = 546 & 580
P/kPa = 25000 - 100000

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in the melt at two experimental temperatures, are presented only in graphical form as a function of the gas pressure in the range 250 - 1000 bar. Values of Henry's law constant, K_H, are:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
273	0.91 ± 0.20
307	1.09 ± 0.15

Smoothed Data:

$$\Delta H/\text{kJ mol}^{-1} = 14.0$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -19.3$$

ΔH is the enthalpy of solution, and $\Delta S°$ is the standard entropy of solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A sample of the saturated melt was isolated and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Argon (99.9%) from British Oxygen Company was used without further purification or drying.

Lithium nitrate (99.9%) obtained from Johnson Matthey & Co. was recrystallized from distilled water and dried at 120°C. It was stored in an air oven at 100°C.

ESTIMATED ERROR:

δP/bar = ± 10

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Argon; Ar; [7440-37-1] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center. Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Five different investigations (1 - 5) are available for the solubility of argon in molten sodium nitrate. Smoothed data from these studies are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}				
T/K	Ref. 1	Ref. 2	Ref.3	Ref. 4	Ref. 5
590	0.57	(0.60)	(22.2)		
600	0.60	(0.64)	(21.7)		
620	0.66	0.70	(20.7)		
640	0.72	0.77	19.9		
642	0.73	0.78	19.8	19.1	17.2
660	0.78	0.84	19.1		
680	(0.85)	0.91	18.4		
700	(0.91)	0.99	17.7		
710	(0.95)	1.03	17.4		

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

According to Copeland and Christie (6), the solubility results reported earlier from their laboratory cannot be considered reliable. Therefore, the values of Copeland **et al.** (3 - 5) are rejected.

The results of Field and Green (1), and of Cleaver and Mather (2) are in very good agreement within the experimental error. The recommended numerical values based on these two data sets are given in Table 1 and Fig. 1.

Table 1 - Recommended Numerical Values

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
590	0.59
600	0.62
610	0.65
620	0.68
630	0.72
640	0.75

continued

References:

1. Field, P. E.; Green, W. J. **J. Phys. Chem.** 1971, **75**, 821.
2. Cleaver, B.; Mather, D. E. **Trans. Faraday Soc.** 1970, **66**, 2469.
3. Copeland, J. L.; Seibles, L. **J. Phys. Chem.** 1968, **72**, 603.
4. Copeland, J. L.; Zybko, W. C. **J. Amer. Chem. Soc.** 1964, **86**, 4734.
5. Copeland, J. L.; Zybko, W. C. **J. Phys. Chem.** 1965, **69**, 3631.
6. Copeland, J. L.; Christie, J. R. **J. Phys. Chem.** 1971, **75**, 103.

COMPONENTS:	EVALUATOR:
(1) Argon; Ar; [7440-37-1] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center. Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
650	0.78
660	0.81
670	0.85
680	0.88
690	0.91
700	0.95
710	0.99

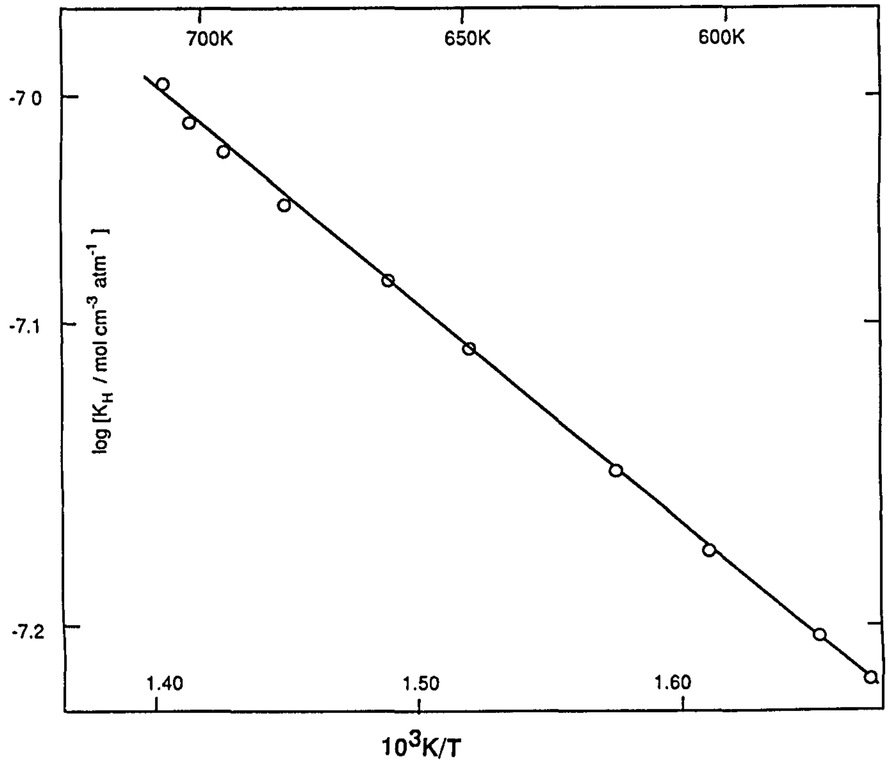


Fig 1

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Field, P. E.; Green, W. J.
J. Phys. Chem. 1971, 75, 821 - 25.

Green, W. J. **Ph.D. Thesis**, Virginia Polytechnic Institute 1969.

VARIABLES:

T/K = 588 - 675
P/kPa = 91.193 - 135.776

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed over the pressure range studied (0.96 - 1.34 atm.). The values of Henry's law constant, K_H, for the solubility of argon in molten $NaNO_3$ at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
588	0.540
595	0.555
607	0.656
609	0.697
614	0.555
618	0.768
628	0.687
632	0.658
637	0.775
655	0.719
675	0.870

Smoothed Data:

The temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = (-5.94 \pm 0.28) - (769.15 \pm 0.18)/(T/K)$$

Std. dev. 1.1%

The enthalpy of solution, ΔH, and entropy of solution, ΔS are :

$$\Delta H/\text{kcal mol}^{-1} = (3.52 \pm 0.81)$$
$$\Delta S/\text{cal K}^{-1}\text{ mol}^{-1} = -(5.58 \pm 1.30) \qquad \text{(at 637K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram of the gas solubility apparatus is given in the original publication.

The experimental process consisted of three steps: saturation, elution and analysis. After saturating the melt with argon, the gas phase was evacuated. Helium was introduced into the system as eluting gas to approximately 1 atm. pressure. The resultant gas mixture of argon and helium was analyzed with an Aerograph Model 90 - P gas chromatograph (Varian). The carrier gas used was also helium. Average of four measurements was used for calculation of the gas solubility.

SOURCE AND PURITY OF MATERIALS:

Argon and helium obtained from Airco were used directly from the cylinder.

Baker's reagent grade sodium nitrate was used without further purification.

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Cleaver, B.; Mather, D. E.

Trans. Faraday Soc.. 1970, 66, 2469 - 82.

VARIABLES:

T/K = 604 - 713

P/kPa = 9000 - 105000

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in the melt at three temperatures are presented in graphical form as a function of the gas pressure in the range range 90 - 1050 bar. The gas solubility versus pressure plot showed curvature above 500 bar. Values of Henry's law constant, K_H, are:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
331	0.64 ± 0.15
410	0.90 ± 0.15
440	1.04 ± 0.15

Smoothed Data:

Temperature dependence of K_H is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\text{ bar}^{-1}) = -5.839 - 819/(T/K) \qquad \text{(compiler)}$$

std. dev. = 0.9% (compiler)

$$\Delta H/\text{kJ mol}^{-1} = 15.8 \qquad \Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -21.7$$

$$\bar{V}_d/\text{ml mol}^{-1} = 34 \pm 8$$

ΔH is the enthalpy of solution, $\Delta S°$ is the standard entropy of solution, and $\bar{V}_d$ is the partial molar volume of the dissolved gas.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A portion of the saturated melt was isolated and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Argon (99.9%) from British Oxygen Company was used without further purification or drying.

Sodium nitrate (>99.5%) A.R. grade from B. D. H. was purified by filtration through Pyrex frits in the molten state. The melt was allowed to freeze and stored in vacuo.

ESTIMATED ERROR:

δP/bar = ± 10

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Seibles, L.

J. Phys. Chem. 1968, 72, 603 - 07.

VARIABLES:

P/kPa = 15288.75 - 40023.38
T/K = 629 - 714

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed for the solubility of argon in molten sodium nitrate upto a saturing gas pressure of 395 atm. The values of Henry's law constant, K_H at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
629	20.2 ± 1.3
642	19.2 ± 0.9
663	19.5 ± 1.3
679.5	18.6 ± 1.1
701	17.7 ± 0.9
714	16.8 ± 1.3

Smoothed Data:

The temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -(6.28 \pm 0.02) + (370 \pm 45)/(T/K)$$

std. dev. = 1.1% (compiler)

The values of the heat of solution, ΔH, and the entropy of solution, $\Delta S°$, are:

$\Delta H/\text{kcal mol}^{-1} = -1.84 \pm 0.21$ $\Delta S°/\text{cal K}^{-1}\ \text{mol}^{-1} = -15.4 \pm 0.3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The experimental arrangement and procedure followed for gas solubility measurements were the same as described earlier (1). Known quantities of the gas and the melt were equilibrated in a heated pressure vessel and the final pressure was measured. The amount of gas dissolved in the melt was determined by subtracting the number of moles of gas present in the gas phase, calculated from the Beattie - Bridgeman equation (2), from the number of moles originally admitted.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Copeland, J. L.; Zybko, W. C. **J. Phys. Chem.** 1965, 69, 3631.
2. Beattie, J. A.; Bridgeman, O. C. **J. Amer. Chem. Soc.** 1928, 50, 3133.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Zybko, W. C.

J. Phys. Chem. 1965, **69**, 3631 - 33.

VARIABLES: P/kPa = 7092.75 - 45697.58
one temperature: T/K = 642

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of argon in molten sodium nitrate at 369°C was measured upto a saturating gas pressure of 451 atm. Henry's law was obeyed. The variation of gas solubility in the melt, C_1, with the saturating gas pressure, P, could be expressed by the equation:

$$C_1/\text{mol cm}^{-3} = (17.2 \times 10^{-7})P/\text{atm} \pm (0.41 \times 10^{-4})$$

The Henry's law constant, K_H, is given as:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
369	17.2 ± 1.7

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the procedure followed for gas solubility measurements have been given in the original paper. Briefly, dry sodium nitrate was placed in the bomb which was then sealed and evacuated. Argon was admitted at room temperature to some desired pressure. The bomb was then heated to a temperature of 642K. Equilibrium was supposed to have been attained when no pressure change was observed for at least 24 h. The number of moles of Ar dissolved in the melt was calculated from the initial and final equilibrium gas pressures, volume and temperature with the aid of detailed plots of P - V - T data compiled by Din (1)

SOURCE AND PURITY OF MATERIALS:

Argon (99.999%) supplied by the National Cylinder Gas Co. was used without further purification.

Reagent grade $NaNO_3$ was obtained from Baker and Adamson and also from Fisher. The Baker and Adamson sample was used without treatment other than drying. The Fisher salt was dried, melted and the pure melt was decanted off.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

1. Din, F.

Thermodynamic Functions of Gases, Vol. 2 Butterworth and Co., London 1962, 192, 193.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Argon; Ar; [7440-37-1] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	Copeland, J. L.; Zybko, W. C. **J. Amer. Chem. Soc.** 1964, **86**, 4734 - 35.
VARIABLES: P/kPa = 36679.65 one temperature: T/K = 642	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of argon in molten sodium nitrate at 369°C was determined upto a saturating gas pressure of 362 atm. Henry's law was obeyed. The value of Henry's law constant, K_H, is given as:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
369	19.15 ± 0.45

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Known quantities of the gas and the melt were equilibrated in a heated pressure vessel and the final pressure was measured. The amount of gas dissolved in the melt was determined by subtracting the number of moles of gas present in the gas phase from the number of moles originally admitted.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Argon; Ar; [7440-37-1] (2) Potassium nitrate; KNO_3; [7757-79-1]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center. Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Two studies (1,2) are available for the solubility of argon in molten KNO_3. However, the temperature intervals of the two studies are different with some overlapping range. The solubility values of Green (1) are much higher than those of Woelk (2).

Further experimental studies are needed before recommended values can be advanced for this system.

References:

1. Green, W. J. **Ph.D. Thesis**, Virginia Polytechnic Institute 1968.

2. Woelk, H. U. **Nukleonik** 1960, 2, 278.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Green, W. J. **Ph.D. Thesis**, Virginia Polytechnic Institute 1969.

Green, W. J.; Field, P. E.
J. Phys. Chem. 1980, **84**, 3111 - 3114.

VARIABLES:

T/K = 608 - 678

P/kPa = 50.663 - 151.988

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of Ar in molten KNO_3 at different temperatures are:

T/K	$10^7\ K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}$
608	1.61
611	1.58
618	1.81
624	1.65
630	1.72
643	1.65
648	1.83
650	1.60
679	2.07

Smoothed Data:
The temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.889 - 553.0/(T/K)$$

std. dev. = 0.87%

The enthalpy of solution, ΔH, and the entropy of solution, ΔS, are:

$\Delta H/\text{kcal mol}^{-1} = 2.53 \pm 0.67$ $\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -5.26 \pm 1.05$ (at 668 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the gas solubility apparatus are given in the original publication.

The experimental process consisted of three steps: saturation, elution and analysis. After saturating the melt with argon, the gas phase was evacuated. Helium gas was introduced into the system as eluting gas to approximately 1 atm. gas pressure. The resultant gas mixture of argon and helium was analyzed with an Aerograph Model 90 - P gas chromatograph (Varian). The carrier gas used was also helium.

SOURCE AND PURITY OF MATERIALS:

Argon and helium obtained from Airco were used directly from the tank.

Reagent grade potassium nitrate from Baker was used without further purification.

ESTIMATED ERROR:

$\delta c/P = \pm 5\%$ (authors)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Woelk, H. U.

Nukleonik 1960, 2, 278 - 79.

VARIABLES:

P/kPa: 101.325 (compiler)

T/K = 652 - 1000

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of argon in molten potassium nitrate have been reported in the temperature interval 650 - 1000K in graphical form only. The values of solubilities derived from this graph, by the compiler, are given below in the form of Henry's law constants, K_H:

T/K	10^8 K_H/mol ml^{-1} atm^{-1}
652	3.8
726	7.1
818	10.3
910	15.8
1000	21.6

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -5.284 - 1380.4/(T/K)$$ (compiler)

std. dev. = 2.5% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 26.4$$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The methods used for solubility measurements was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Woelk, H. U.
Chem. - Ing. - Techn.
32, 765(1960).

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Rubidium nitrate; $RbNO_3$; [13126-12-0]

ORIGINAL MEASUREMENTS:

Cleaver, B.; Mather, D. E.

Trans. Faraday Soc. 1970, **66**, 2469 - 82.

VARIABLES:

T/K = 604 & 713

P/kPa = 24000 - 100000

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in the melt are presented at two experimental temperatures, only in the graphical form as a function of the gas pressure in the range 240 - 1000 bar. Values of Henry's law constant, K_H, are:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
331	1.30 ± 0.2
440	2.40 ± 0.2

Smoothed Data:

$$\Delta H/kJ\ mol^{-1} = 20.1$$

$$\Delta S°/J\ K^{-1}\ mol^{-1} = -8.6$$

ΔH is the enthalpy of solution, and $\Delta S°$ is the standard entropy of solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A sample of the saturated melt was removed and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Argon (99.9%) from British Oxygen Company was used without further purification or drying.

Rubidium nitrate (99.9%) from Johnson - Matthey & Co. was purified by filtration through Pyrex frits in the fused state. The melt was allowed to freeze and stored **in vacuo.**

ESTIMATED ERROR:

δP/bar = ± 10

REFERENCES:

COMPONENTS: (1) Argon; Ar; [7440-37-1] (2) Rubidium nitrate; $RbNO_3$; [13126-12-0]	ORIGINAL MEASUREMENTS: Cleaver, B.; Williams, J. F. **J. Phys. Chem. Solids** 1968, **29**, 877 - 880.
VARIABLES: P/kPa = 101.325 - 50662.5 one temperature: T/K = 585.5	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of argon in molten rubidium nitrate is:

t/°C	solubility/mol ml^{-1} atm^{-1}
Freezing Point of $RbNO_3$ (312.5)	2.0 X 10^{-7}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryscopy.

Molten rubidium nitrate was allowed to equilibrate for twelve hours in contact with argon gas, at pressures up to 500 atm. The freezing point of argon saturated $RbNO_3$ was measured. Henry's law constant was calculated using Raoult's law and the heat of fusion of $RbNO_3$ (4.644 kJ mol^{-1}).

SOURCE AND PURITY OF MATERIALS:

Rubidium nitrate (99.9%) from Johnson, Matthey and Co. was recrystallized from distilled water.

Source and purity of argon not given.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Argon; Ar; [7440-37-1] (2) Silver nitrate; $AgNO_3$; [7761-88-8]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Only two studies (1 - 2) have been reported for the solubility of argon in molten silver nitrate. The solubility values from these investigations are compared below:

	$10^7\ K_H$/mol cm^{-3} atm^{-1}	
T/K	Cleaver & Mather	Copeland & Radak
507	0.19 ± 0.05	
523		33.5 ± 5.5

According to Copeland and Christie (3), the solubility results reported earlier from their laboratory cannot be considered reliable. The value of Cleaver and Mather (1) may be treated as more reliable, at least tentatively.

More detailed investigations are needed before recommended values can be advanced.

References:

1. Cleaver, B.; Mather, D. E. **Trans. Faraday Soc.** 1970, **66**, 2469.
2. Copeland, J. L.; Radak, S. **J. Phys. Chem.** 1967, **71**, 4360.
3. Copeland, J. L.; Christie, J. R. **J. Phys. Chem.** 1971, **75**, 103.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Argon; Ar; [7440-37-1] (2) Silver nitrate; $AgNO_3$; [7761-88-8]	Cleaver, B.; Mather, D. E. **Trans. Faraday Soc.** 1970, **66**, 2469 - 82.
VARIABLES: P/kPa = 33000 - 95000 one temperature: T/K = 507	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in the melt are presented at only one temperature, in the graphical form as a function of the gas pressure in the range 330 - 950 bar. The value of Henry's law constant, K_H, at the experimental temperature is:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
234	0.19 ± 0.05

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A sample of the saturated melt was isolated and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Argon (99.9%) from British Oxygen Company was used without further purification or drying.

Silver nitrate (99.9%) obtained from Johnson - Matthey & Co. was recrystallized from distilled water.

ESTIMATED ERROR:

δP/bar = ± 10

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Silver nitrate; $AgNO_3$; [7761-88-8]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Radak, S.

J. Phys. Chem. 1967, 71, 4360 - 65.

VARIABLES:

P/kPa = 4762.275 - 37996.875

one temperature: T/K = 523

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of argon in molten silver nitrate at 523K was determined upto a saturating gas pressure of 375 atm. Henry's law was obeyed. The value of Henry's law constant, K_H, is given as:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
250	3.35 ± 0.55

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The equipment and technique used for gas solubility measurements were exactly the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Argon (99.98%) was obtained from the National Cylinder Gas Co.

Reagent grade silver nitrate obtained from Mallinckrodt, Fisher Scientific and Baker were used. Before each measurement, silver nitrate was fused, allowed to cool and solidify in a porcelain casserole placed in a desiccator, and then finely pulverized.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Copeland, J. L.; Zybko, W. C.

J. Phys. Chem. 1965, 69, 3631.

COMPONENTS: (1) Argon; Ar; [7440-37-1] (2) Sodium chloride; NaCl; [7647-14-5]	**ORIGINAL MEASUREMENTS:** Novozhilov, A. L.; Devyatkin, V. N.; Pchelina, E. I. **Abstracts of Repts. V All Union Conf. Phys. Chem. Electrochem. of Fused Salts, Oxide Melts, Solid Electrolytes**, Sverdlovsk, 1973, Part 1, 118.
VARIABLES: P/kPa: 101.325 (compiler) T/K = 1123 - 1223	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant , K_H, for the solubility of argon in molten NaCl at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1123	1.28
1173	1.54
1223	2.02

Smoothed Data:

The temperature dependence of K_H could be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.484 - 2712.1/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.9% (compiler)

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = 51.9 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Not available.	**SOURCE AND PURITY OF MATERIALS:** Not available.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Argon; Ar; [7440-37-1] (2) Potassium chloride; KCl; [7447-40-7]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

The solubility of argon in molten potassium chloride has been studied by two different groups (1 - 2). Smoothed data from the two studies are compared below at different temperatures:

	$10^7\ K_H$/mol cm^{-3} atm^{-1}	
T/K	Novozhilov et al. (1)	Waelk (2)
1100	(3.08)	4.78
1140	3.53	5.47
1180	4.01	6.21
1220	4.51	6.98
1260	(5.05)	7.80
1300	-	8.65
1400	-	10.91
1500	-	(13.36)

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

The results of Woelk are about 55% higher compared to those of Novozhilov et al. The enthalpies of solution in the two studies are in excellent agreement. This indicates that the disagreement between the results lies in magnitude rather than in the temperature dependence of the solubility.

Further investigations are needed before this system can be properly evaluated and recommended values can be advanced.

References:

1. Novozhilov, A. L.; Devyatkin, V. N.; Pchelina, E. I. **Abstracts of Repts. V All Union Conf. Phys. Chem. Electrochem of Fused Salts, Oxide Melts, Solid Electrolytes, Sverdlovsk** 1973, Part 1, 118.

2. Woelk, H. U. **Nukleonik** 1960, 2, 278.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Devyatkin, V. N.; Pchelina, E. I.
Abstracts of Repts. V All Union Conf. Phys. Chem. Electrochem. of Fused Salts, Oxide Melts, Solid Electrolytes, Svedlovsk, 1973, **Part** 1, 118.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 1123 - 1223

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in molten KCl at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1123	3.32
1173	3.96
1223	4.53

Smoothed Data:

The temperature dependence of K_H could be expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.822 - 1859.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.6% (compiler)

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = 35.6$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Not available.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium chloride; KCl;
[7447-40-7]

ORIGINAL MEASUREMENTS:

Woelk, H. U.

Nukleonik 1960, 2, 278 - 79.

VARIABLES:

P/kPa: 101.325 (compiler)

T/K = 1088 - 1495

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in molten KCl at different temperatures have been reported only in graphical form.

The values of solubilities derived from this graph are given below in the form of Henry's law constants, K_H:

T/K	10^7 K_H/mol ml^{-1} atm^{-1}
1088	4.39
1140	5.73
1224	6.99
1286	8.51
1495	13.02

Smoothed Data:

Temperature dependence of K_H is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -4.647 - 1841/(T/K) \qquad \text{(compiler)}$$

std. dev. = 1.7% (compiler)

The heat of solution, ΔH, is calculated to be:

$$\Delta H/\text{kJ mol}^{-1} = 35.2 \qquad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The procedure employed for solubility was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Woelk, H. U.
   Chem. - Ing. - Techn.
   32, 765(1960).

COMPONENTS: (1) Argon; Ar; [7440-37-1] (2) Rubidium chloride; RbCl; [7791-11-9]	**ORIGINAL MEASUREMENTS:** Novozhilov, A. L.; Devyatkin, V. N.; Pchelina, E. I. **Abstracts of Repts. V All Union Conf. Phys. Chem. Electrochem. of Fused Salts, Oxide Melts, Solid Electrolytes,** Sverdlovsk, 1973, **Part** 1, 118.
VARIABLES: P/kPa: 101.325 (compiler) T/K = 1073 - 1173	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in molten RbCl at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1073	3.28
1123	3.72
1173	4.38

Smoothed Data:

The temperature dependence of K_H could be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = 5.015 - 1579.2/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.9% (compiler)

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = 30.2 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Not available.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Cesium chloride; CsCl; [7647-17-8]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Devyatkin, V. N.; Pchelina, E. I.
Vth All-Union Conf. Phys. Chem. Electrochem. of Fused Salts, Oxide Melts, Solid Electrolytes, Sverdlovsk, Part1, 1973, 118.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 1073 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in molten CsCl at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1073	4.10
1123	4.66
1173	5.14

Smoothed Data:

The temperature dependence of K_H could be expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.231 - 1238.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.4% (compiler)

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = 23.7 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Not available.

SOURCE AND PURITY OF MATERIALS:

No details given.

ESTIMATED ERROR:

Std. Dev. = ± 0.4% (compiler)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Zinc chloride; $ZnCl_2$; [7646-85-7]

ORIGINAL MEASUREMENTS:

Borodzinski, A.; Sokolowski, A.; Suski, L.

J. Chem. Thermodyn. 1975, 7, 655 - 60.

VARIABLES:

one temperature: T/K = 720
P/kPa = 20 - 100

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of argon in the melt the Henry's law constant, K_H, is:

T/K	10^{10} x_1/mol fraction P_a^{-1}	10^7 K_H/mol ml^{-1} atm^{-1}
720	4.77 ± 0.03	8.23[a]

[a] Value calculated by the compiler using density of $ZnCl_2$ from Janz, G. J. **"Molten Salts HandBook"** Academic Press, 1967.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

The experimental arrangement used is described in detail in the original paper. The melt was saturated with argon. The process of saturation was enhanced by a magnetic stirrer. The change in volume of the gas caused by its dissolution in the melt was determined. Temperature was controlled within ± 1K.

SOURCE AND PURITY OF MATERIALS:

Argon was 99.99% pure.
Zinc chloride p. a. was distilled under vacuum prior to its distillation directly into the apparatus.

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium bromide; KBr; [7758-02-3]

ORIGINAL MEASUREMENTS:

Woelk, H. U.

Nukleonik 1960, 2, 278 - 79.

VARIABLES:

T/K = 1017 - 1151
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in molten KBr at different temperatures have been reported in graphical form only.

The values of solubilities derived from this graph by the compiler are given below in the form of Henry's law constants, K_H:

T/K	$K_H \times 10^7$/mol ml^{-1} atm^{-1}
1017	6.43
1083	7.76
1151	9.12

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -4.887 - 1326/(T/K)$$ (compiler)

std. dev. = 0.2% (compiler)

The heat of solution, ΔH, is calculated to be:

$$\Delta H/\text{kJ mol}^{-1} = 25.4$$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The procedure employed for solubility measurements has been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Woelk, H. U.
Chem. - Ing. - Techn.
32, 765(1960)

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium iodide; KI;
[7681-11-0]

ORIGINAL MEASUREMENTS:

Woelk, H. U.

Nukleonik 1960, 2, 278 - 79.

VARIABLES:

P/kPa: 101.325 (compiler)

T/K = 985 - 1263

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in molten KI at different temperatures have been reported only in graphical form.

The values of solubilities derived from this graph by the compiler are given below in the form of Henry's law constants, K_H:

T/K	10^7 K_H/mol ml^{-1} atm^{-1}
985	8.0
1053	9.9
1125	11.8
1184	14.3
1263	16.6

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -4.642 - 1434.5/(T/K)$$ (compiler)

std. dev. = 0.8% (compiler)

The heat of solution, ΔH, is calculated to be:

ΔH/kJ mol^{-1} = 27.5 (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The procedure used for the solubility measurements was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Woelk, H. U.
Chem. - Ing. - Techn.
32, 765(1960).

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Argon; Ar; [7440-37-1] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** <u>1972</u>, **68**, 2083 - 89.
VARIABLES:	**PREPARED BY:**
T/K = 508 - 603 P/kPa = 10^2	N. P. Bansal

EXPERIMENTAL VALUES:

The solvent was an equimolar mixture of sodium nitrate and potassium nitrate. The solubilities of argon in the melt at different temperatures are:

T/K	10^8 K_H/mol cm^{-3} bar^{-1}
508	1.0
533	1.3
573	1.7
603	2.1

Smoothed Data:

The temperature dependence of Henry's law constant, K_H, is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{bar}^{-1}) = -5.99 - 1017.4/(T/K)$$ (compiler)

std. dev. = 1.1% (compiler)

The enthalpy, ΔH, and the standard entropy, $\Delta S°$, of solution are:

$$\Delta H/\text{kJ mol}^{-1} = 18.5$$

$$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -28$$ (at 533 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The details of the apparatus and procedure employed for solubility measurements are described elsewhere (1). Briefly, the melt was vacuum - degassed for a few hours. The vacuum was disconnected and argon gas introduced at about one bar pressure. The melt was vigorously stirred and pressure changes were noted with a manometer as a function of time until the equilibrium was reached.
The amount of gas dissolved was calculated from the final variation after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

Argon (High Purity Grade) was purified by keeping it in contact with Ascarite (A. H. Thomas Co.,) for several hours to remove CO_2 and other acidic impurities and molecular sieve 5A (Carlo Erlie, Milano) at -80°C to remove water.

Reagent grade sodium and potassium nitrates were used to prepare the melt which was filtered in the molten state.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.

J. Electroanal. Chem. <u>1972</u>, **38**, 373.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Watson, G. M.; Evans III, R. B.; Grimes, W. R.; Smith, N. V.

J. Chem. Eng. Data 1962, **7**, 285 - 87.

VARIABLES:

$P/kPa = 101.325 - 202.650$
$T/K = 773 - 1073$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in the melt LiF - BeF_2 (64 - 36 mol%) at different temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
500	0.54 ± 0.02
600	0.98 ± 0.02
700	1.69 ± 0.10
800	2.66 ± 0.15

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.797 - 1918/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.5% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = 8.6$$

$$\Delta S°/\text{cal K}^{-1}\text{ mol}^{-1} = -4.2 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping or elution method.

The apparatus and procedure used for gas solubility measurements have been described elsewhere (1,2).

SOURCE AND PURITY OF MATERIALS:

Argon gas, (> 99.9%), was obtained from the Linde Co.
LiF was reagent grade. BeF_2 (99.5 ± 0.5%) was obtained from the Beryllium Corp. of America.
The melt was prepared by mixing the two fluorides in proper proportions. The melt was purified by flushing it alternately with anhydrous HF and F_2 at 800°C

ESTIMATED ERROR:

solubility = ± 10%

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, **62**, 862.

2. Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M.
Ibid. 1959, **63**, 1164.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Ward, W. T.; Watson, G. M.; Evans, R. B.; Grimes, W. R.

U.S.A.E.C. Rept. O.R.N.L. - 2931 1960, 29 - 31.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 773 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in the molten salt solvent NaF - BeF_2 (57 - 43 mol%) at different temperatures are:

t/°C	10^7 K_H^*/mol cm^{-3} atm^{-1}
500	1.16
600	1.92
700	2.97
800	4.55

* Values read from graph.

Smoothed Data:
Temperature dependence of K_H can be expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.839 - 1629.2/(T/K) \qquad \text{(compiler)}$$

std. dev. = 1.8 %

The heat of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

ΔH/kcal mol^{-1} = 7.5 (compiler) $\Delta S°$/cal K^{-1} mol^{-1} = -3.1 (at 1000 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The method used for the determination of gas solubilities in the molten salt solvent was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, **62**, 862.

COMPONENTS:

(1) Argon; Ar; [7440-37-1]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862 - 66.

VARIABLES: $P/kPa = 50.663 - 202.650$

$T/K = 873 - 1073$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in the melt NaF - ZrF_4 (53 - 47 mol%) at different temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	5.06 ± 0.15
700	8.07 ± 0.08
800	12.0 ± 0.6

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.286 - 1755.8/(T/K)$$ (compiler)

std. dev. = 0.4% (compiler)

The enthalpy of solution, ΔH, and the entropy, ΔS, of dissolving the gas with equal concentrations in the gaseous and liquid states are:

$$\Delta H/\text{kcal mol}^{-1} = 8.2$$

$$\Delta S/\text{cal K}^{-1}\text{ mol}^{-1} = -1.5$$ (at 1000 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus and procedure are described in detail in the original publication. In brief, the melt was saturated with argon by sparging it with the gas for 6 hours at the desired gas pressure. Part of the molten salt solution was transferred into the stripping section. The dissolved argon was stripped from the melt by circulation of helium through the system for about 15 minutes. The amount of argon present in the eluted gas mixture was determined by mass spectrometry.

SOURCE AND PURITY OF MATERIALS:

Argon gas, (>99.9%) was obtained from Linde Air Products Company.

Sodium fluoride of reagent grade was obtained from Mallinckrodt Chemical Co.

ZrF_4 was prepared by hydrofluorination of $ZrCl_4$ at 500°C in nickel apparatus. The melt was prepared by mixing the two salts in proper ratio and purified at 800°C by sparging it alternately with anhydrous HF and H_2. No oxide was present in the melt.

ESTIMATED ERROR:

solubility = ± 10% (author)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Sodium oxide; Na_2O; [1313-59-3]

(3) Vanadium oxide; V_2O_5; [1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E. G.; Fedorov, A. A.; Ponomarev, V. E.
Zhur. Fiz. Khim. 1983, 57, 779-780;
Russ. J. Phys. Chem. (Eng. Transl.) 1983, 57, 478 - 479. (*).

VARIABLES:

T/K = 808 - 951
V_2O_5 / mole % = 61 - 70
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's Law Constants, K_p(mol cm^{-3} atm^{-1}), for the solubility of argon in Na_2O - V_2O_5 melts of various compositions were determined at different temperatures. Coefficients of the equation log $K_p = A+B/T \pm \Delta$, where Δ is the error obtained by linear least squares fit of the data are given below:

Melt composition/ mole % V_2O_5	Temp. range (K)	-A	-B	Δ
61.0	808 - 903	2.506	3583	0.027
70.0	848 - 951	2.652	3304	0.010

The enthalpies ($\Delta H°$) and entropies ($\Delta S°$) of the solution were evaluated from the temperature dependence of the solubility constants expressed as $K_o = C_m/C_g$, where C_m and C_g are the volume concentrations of the dissolved gas in the liquid and the gas phase respectively, are given below:

Melt composition/ mole % V_2O_5	$\Delta H°$/kJ mol^{-1}	$\Delta S°$/J$K^{-1}mol^{-1}$ (at 855K)
61.0	75.55	50.06
70.0	70.37	51.88

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas (helium) as well as by a gas - volumetric method. The discrepancy between the results of the two methods was 10 - 20 %.

The V_2O_5 content in the melt was determined by an amperometric titration.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1)Argon; Ar; [7440-37-1]

(2)Potassium Oxide; K_2O; [12136-45-7]

(3)Vanadium Oxide; V_2O_5; [1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E.G; Fedorov, A. A.; Ponomarev, V. E.;Ketov, A. N.
Zhur. Fiz. Khim. 1982, **56**, 474 - 475;
Russ. J. Phys. Chem. 1982,**56**, 292 - 293.

VARIABLES:

T/K = 773 - 909
V_2O_5/mol% = 55.5 - 66.5
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of argon in K_2O - V_2O_5 melts of various compositions were determined at various temperatures at an initial pressure of 1 atm. The average gas solubilities obtained from five measurements at each temperature are given below :

55.5 mole % V_2O_5		61.0 mole % V_2O_5		66.5 mole % V_2O_5	
T/K	10^7 cm/mol cm^{-3} atm^{-1}	T/K	10^7 cm/mol cm^{-3} atm^{-1}	T/K	10^7cm/mol cm^{-3} atm^{-1}
816	0.89	773	1.20	783	3.47
858	1.55	813	2.04	810	3.63
876	1.78	828	2.34	837	4.57
898	1.95	853	2.69	873	7.08
		893	4.37	909	7.76

The enthalpies of solution, ΔH°, and the entropies of solution, ΔS°, were evaluated from the temperature dependence of the solubility constants expressed as $k_o = C_m/C_g$ where C_m(mol cm^{-3}) is the concentration of the gas in the melt and C_g is the concentration of the gas in the gas phase in mole cm^{-3}. Thermodyanamic parameters at 855K are give below :

Mole % V_2O_5	ΔH°/kJ mol^{-1}	ΔS°/J mol^{-1}K^{-1}
55.5	65.83	57.42
61.0	64.41	42.83
66.5	53.72	35.96

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Desorption Method : Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas using a standard method. The argon content in the gas mixture was estimated by analysis based on thermal conductivity.
Volumetric Method : Recrystallized potassium metavanadate and vanadium pentoxide were fused together. The possible reducing impurities present in the melt were oxidized by bubbling oxygen for 3h. at 550°C. The dissolved oxygen was removed by bubbling helium through the melt for 30 min.
The discrepancy between the solubilities determined by the two methods was ± 10%

SOURCE AND PURITY OF MATERIALS:

Potassium metavanadate of "chemically pure" grade was recrystallized.

Vanadium pentoxide of "specially pure" grade was used.

ESTIMATED ERROR:

Solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Potassium oxide; K_2O; [12136-45-7]

(3) Vanadium oxide; V_2O_5; [1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E. G.; Fedorov, A. A.; Ponomarev, V. E.
Zhur. Fiz. Khim. 1983, **57**, 779-780;
Russ. J. Phys. Chem. (Eng. Transl.) 1983, 57, 478 - 479. (*).

VARIABLES:

T/K = 773 - 909
V_2O_5 / mole % = 55 - 66.5
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's Law Constants, K_p(mol cm^{-3} atm^{-1}), for the solubility of argon in K_2O - V_2O_5 melts of various compositions were determined at different temperatures. Coefficients of the equation $\log K_p = A + B/T \pm \Delta$, where Δ is the error obtained by linear least squares fit of the data are given below:

Melt composition/ mole % V_2O_5	Temp. range (K)	-A	-B	Δ
55.0	800 - 898	3.027	3067	0.014
61.0	773 - 893	3.164	1863	0.038
66.5	783 - 909	3.392	2434	0.011

The enthalpies ($\Delta H°$) and entropies ($\Delta S°$) of the solution were evaluated from the temperature dependence of the solubility constants expressed as $K_o = C_m/C_g$, where C_m and C_g are the volume concentrations of the dissolved gas in the liquid and the gas phase respectively, are given below:

Melt composition/ mole % V_2O_5	$\Delta H°$/kJ mol^{-1}	$\Delta S°$/JK^{-1}mol^{-1} (at 855K)
55.0	65.83	57.42
61.0	64.40	42.83
66.5	53.72	35.96

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas (helium) as well as by a gas - volumetric method. The discrepancy between the results of the two methods was 10 - 20 %.

The V_2O_5 content in the melt was determined by an amperometric titration.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Argon; Ar; [7440-37-1]

(2) Cesium Oxide; Cs_2O;
[20281-00-9]
(3) Vanadium oxide; V_2O_5;
[1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E. G.; Fedorov, A. A.; Ponomarev, V. E.
Zhur. Fiz. Khim. 1983, 57, 779-780;
Russ. J. Phys. Chem. (Eng. Transl.) 1983, 57, 478 - 479. (*).

VARIABLES:

T/K = 673 - 922
V_2O_5 / mole % = 55 - 61
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's Law Constants, K_p(mol cm^{-3} atm^{-1}), for the solubility of argon in Cs_2O - V_2O_5 melts of various compositions were determined at different temperatures. Coefficients of the equation $\log K_p = A+B/T \pm \Delta$, where Δ is the error obtained by linear least squares fit of the data are given below:

Melt composition/ mole % V_2O_5	Temp. range (K)	-A	-B	Δ
50.0	832 - 922	3.030	3000	0.009
61.0	673 - 825	4.328	1863	0.028

The enthalpies ($\Delta H°$) and entropies ($\Delta S°$) of the solution were evaluated from the temperature dependence of the solubility constants expressed as $K_c = C_m/C_g$, where C_m and C_g are the volume concentrations of the dissolved gas in the liquid and the gas phase respectively, are given below:

Melt composition/ mole % V_2O_5	$\Delta H°$/kJ mol^{-1}	$\Delta S°$/J$K^{-1}mol^{-1}$ (at 855K)
50.0	64.55	43.07
61.0	53.06	32.68

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas (helium) as well as by a gas - volumetric method.
The discrepancy between the results of the two methods was 10 - 20 %.

The V_2O_5 content in the melt was determined by an amperometric titration.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Argon; Ar; [7440-37-1] (2) Lithium fluoride; LiF; [7789-24-4] (3) Sodium fluoride; NaF; [7681-49-4] (4) Potassium fluoride; KF; [7789-23-3]	Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M. **J. Phys. Chem.** 1959, 63, 1164 - 67.
VARIABLES:	PREPARED BY:
T/K = 873 - 1073 P/kPa = 101.325 - 202.650	N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of argon in the molten eutectic LiF - NaF - KF (46.5 - 11.5 - 42.0 mol%) at different temperatures, and pressures ranging from 1 - 2 atm, are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	0.90 ± 0.04
700	1.80 ± 0.04
800	3.40 ± 0.03

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.959 - 2699.8/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.4\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = 12.4$$

$$\Delta S°/\text{cal K}^{-1}\text{ mol}^{-1} = -0.1 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The apparatus and procedure employed have been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Argon gas, purity better than 99.9%, was obtained from Linde Air Products Company.

The melt was prepared by mixing Reagent grade LiF, NaF and KF in appropriate amounts. The melt was purified at 800°C by flushing it alternately with anhydrous HF and H_2. Nickel apparatus was used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Xenon; Xe; [7440-63-3]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Watson, G. M.; Evans III, R. B.; Grimes, W. R.; Smith, N. V.

J. Chem. Eng. Data 1962, **7**, 285 - 87.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 873 -1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constants, K_H, for the solubility of xenon in the melt LiF - BeF_2 (64 - 36 mol%) at different temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	0.233 ± 0.004
650	0.333 ± 0.015
700	0.505 ± 0.020
800	0.863 ± 0.020

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.543 - 2698/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.6% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, ΔS°, are:

$$\Delta H/\text{kcal mol}^{-1} = 12.1$$

$$\Delta S°/\text{cal K}^{-1}\text{ mol}^{-1} = -3.1 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping or elution method.

The apparatus and procedure used for gas solubility measurements was the same as described elsewhere (1,2).

SOURCE AND PURITY OF MATERIALS:

Xenon gas, (>99.9%) was obtained form the Linde Co.

LiF was of reagent grade. BeF_2 (99.5 ± 0.5%) was obtained from the Beryllium Corp. of America.

The melt was prepared by mixing the two fluorides in proper proportions. The melt was purified by sparging it alternately with anhydrous HF and F_2 at 800°C.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, **62**, 862.

2. Blander, M.; Grimes, W. R.; Smith, N. V.; Watson, G. M.
Ibid. 1959, **63**, 1164.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Xenon; Xe; [7440-63-3] (2) Sodium fluoride; NaF; [7681-49-4] (3) Beryllium fluoride; BeF_2; [7789-49-7]	Ward, W. T.; Watson, G. M.; Evans, R. B.; Grimes, W. R. **U.S.A.E.C. Rept. O.R.N.L.-2931** 1960, 29 - 31.
VARIABLES: P/kPa = 101.325 - 202.650 T/K = 773 - 1073	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of xenon in the molten solvent NaF - BeF_2 (57 - 43 mol%) at different temperatures are:

t/°C	10^9 $K_H{}^*$/mol cm^{-3} atm^{-1}
500	2.10
600	3.84
700	8.60
800	15.97

* Values read from the graph by the compiler.

Smoothed Data:
Temperature dependence of K_H can be expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.529 - 2464/(T/K) \quad \text{(compiler)}$$

std. dev. = 5.7% (compiler)

The heat of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

ΔH/kcal mol^{-1} = 11.28 (compiler) $\Delta S°$/cal K^{-1} mol^{-1} = -2.3 (at 1000 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The method used for the determination of gas solubilities in the molten salt solvent was the same as described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, **62**, 862.

COMPONENTS:

(1) Xenon; Xe; [7440-63-3]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862 - 66.

VARIABLES:

$P/kPa = 101.325 - 202.650$
$T/K = 873 - 1073$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of xenon in the melt NaF - ZrF_4 (53 - 47 mol%) at different temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	1.94
700	3.56
800	6.32

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{mol}^{-1}) = -4.972 - 2397.3/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.6\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the entropy, ΔS, of dissolving the gas with equal concentrations in the gaseous and liquid states are:

$$\Delta H/\text{kcal mol}^{-1} = 11.1$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -0.1 \quad \text{(at 1000 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus and procedure used are described in detail in the original paper. Briefly, the melt was saturated with xenon by sparging it with the gas for 6 hours at the desired gas pressure. Part of the molten salt was transferred into the stripping section. The dissolved xenon was stripped from the melt by circulation of helium through the system for about 15 minutes. The amount of xenon present in the eluted gas mixture was determined by mass spectrometry.

SOURCE AND PURITY OF MATERIALS:

Xenon gas, (>99.9%) was obtained from Linde Air Products Company.

Sodium fluoride of reagent grade was obtained from Mallinckrodt Chemical Co.

ZrF_4 was prepared by hydrofluorination of $ZrCl_4$ at 773K in nickel apparatus. The melt was prepared by mixing the two salts in proper amounts and purified at 800°C by sparging it alternately with anhydrous HF and H_2. No oxide was present in the melt.

ESTIMATED ERROR:

solubility: ± 20% (authors)

REFERENCES:

COMPONENTS:

(1) Xenon; Xe; [7440-63-3]

(2) Sodium fluoride; NaF; [7681-49-4]

(3) Zirconium fluoride; ZrF_4 [7783-64-4]

(4) Uranium tetrafluoride; UF_4; [10049-14-6]

ORIGINAL MEASUREMENTS:

Grimes; W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862 - 66.

VARIABLES:

T/K = 873 - 1073

P/kPa = 50.663 - 202.650

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of xenon in the melt NaF - ZrF_4 - UF_4 (50 - 46 - 4 mol%) at pressures ranging from 0.5 - 2 atm. and at three temperatures are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
873	2.0
973	4.0
1073	6.5

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.939 - 2404.3/(T/K)$$ (compiler)

std. dev. = 1.5% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 46.0$$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus and procedure used are described in detail in the original paper. Briefly, the melt was saturated with xenon by sparging it with the gas for 6 hours at the desired gas pressure. Part of the molten salt solution was transferred into the stripping section. The dissolved xenon was stripped from the melt by circulation of helium through the system for about 15 minutes. The amount of xenon present in the eluted gas mixture was determined by mass spectrometry.

SOURCE AND PURITY OF MATERIALS:

Xenon gas, (>99.9%) was obtained from Linde Air Products Co.

Reagent grade NaF and UF_4 were obtained from Mallinckrodt Chemical Co. ZrF_4 was prepared by hydrofluorination of $ZrCl_4$ at 773K in nickel apparatus.

The melt was prepared by mixing the three salts in proper amounts and purified at 800°C by sparging it alternately with anhydrous HF and H_2 No oxide was present in the melt.

ESTIMATED ERROR:

solubility: ± 20% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen; H_2; [1333-74-0] (2) Sodium hydroxide; NaOH; [1310-73-2]	Sullivan, E. A.; Johnson, S.; Banus, M. D. J. Amer. Chem. Soc. 1955, 77, 2023 - 24.
VARIABLES:	PREPARED BY:
one temperature: T/K = 773 P/kPa = 689.286 - 5514.286	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of hydrogen in molten NaOH at 500°C was found to be less than 60 mg of H_2/100 g of melt unless corrosion products are present. Presence of corrosion products increase the solubility of hydrogen. The solubility of H_2 in the melt was found to be independent of temperature and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility measurements were carried out by introducing a known amount of hydrogen into the system above the melt and allowed to attain equilibrium. The fall in pressure was recorded with a pressure gauge and the solubility calculated.

SOURCE AND PURITY OF MATERIALS:

NaOH contained 0.07% sodium carbonate and other trace impurities. It was specially dehydrated.

The container for molten hydroxide was made from INCO Grade "L" nickel. It was pretreated at 400°C with alter -nate 30 minute cycles of hydrogen and vacuum for four hours to free it from any surface oxidation and adsorbed gases.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen; H_2; [1333-74-0] (2) Potassium hydroxide; KOH; [1310-58-3]	Sullivan, E. A.; Johnson, S.; Banus, M. D. J. Amer. Chem. Soc. 1955, 77, 2023 - 24.
VARIABLES:	**PREPARED BY:**
T/K = 683 - 773 P/kPa = 689.286 - 5514.286	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of hydrogen in molten KOH was determined at 410 and 500°C. It was found to be less than 60 mg of H_2/100 g of melt in the absence of corrosion products. Presence of corrosion products increase the solubility of hydrogen. The solubility of H_2 in the melt was found to be independent of temperature and pressure.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility measurements were carried out by introducing a known quantity of hydrogen into the system above the melt and allowing it to equilibrate. The gas solubility was calculated from the drop in pressure which was measured with a pressure gauge.

SOURCE AND PURITY OF MATERIALS:

KOH contained 0.12% potassium carbonate and other trace impurities. It was specially dehydrated.

The container for molten hydroxide was made from INCO Grade "L" nickel. It was pretreated at 400°C with alternate 30 minute cycles of hydrogen and vacuum for four hours to free it from any surface oxidation and adsorbed gases.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Hydrogen; H_2; [1333-74-0]

(2) Dilithium beryllium fluoride; Li_2BeF_4

ORIGINAL MEASUREMENTS:

Malinauskas, A. P.; Richardson, D. M.

Ind. Eng. Chem. Fundam. <u>1974</u>, **13**, 242 - 245.

VARIABLES:

P/kPa = 101.325 - 202.650

T/K = .73 - 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, and the Ostwald coefficient, K_C, for the solubility of hydrogen in molten Li_2BeF_4 at different temperatures are:

T/K	10^8 $K_H{}^a$/mol cm^{-3} atm^{-1}	10^3 K_C
773	1.78 ± 0.13	1.13 ± 0.08
873	4.42 ± 0.12	3.17 ± 0.09
973	4.84 ± 0.46	3.87 ± 0.37

[a] Calculated by the compiler using the relation $K_H = K_C/RT$.

Smoothed Data:

Temperature dependence of K_H and K_C are expressed by the equations:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.535 - 1677.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 12.5% (compiler)

$$\log K_C = \log(T/K) - 1535/(T/K) - 3.7684$$

The enthalpy of solution, ΔH, is calculated to be:

$$\Delta H/\text{kJ mol}^{-1} = 32.1 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The diagram and details of the apparatus and the experimental procedure are described in (1). In brief, the melt was saturated with hydrogen and a known volume of the saturated solution was transferred to the stripper. The dissolved hydrogen was freed by sparging with xenon and analyzing by mass spectroscopy.

SOURCE AND PURITY OF MATERIALS:

Hydrogen and xenon were at least 99.9% pure. Hydrogen gas was purified by passing through liquid nitrogen cooled coils of copper tubing.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Malinauskas, A. P., Richardson, D. M.; Savolainen, J. E.; Shaffer, J. H. **Ind. Eng. Chem. Fundam.** <u>1972</u>, 11, 584.

COMPONENTS:

(1) Hydrogen; H_2; [1333-74-0]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Malinauskas, A. P.; Richardson, D. M.; Savolainen, J. E.; Shaffer, J. H.
Ind. Eng. Chem. Fundam. 1972, **11**, 584 - 86.

VARIABLES:

one temperature: T/K = 873
P/kPa = 101.325 - 202.650

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The value of the Henry's law constant, K_H, for the solubility of hydrogen in the molten eutectic LiF - BeF_2 (66 -34 mol%) is:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
600	4.34 ± 0.20

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The diagram and details of the apparatus used and procedure followed are given in the original paper. The main parts of the apparatus were constructed of Hastelloy, a nickel base alloy containing 7% Cr, 4% Fe, 12 - 17% Mo. In an experiment the melt in the saturation chamber was saturated with hydrogen by bubbling the gas through it. A known quantity of saturated solution was transferred into the stripping chamber where the dissolved gas was stripped from the solvent and collected for measurement.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Hydrogen; H_2; [1333-74-0]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Chem. Soc. Faraday Trans I 1973, **69**, 2014 - 18.
Proc. Int. Symp. Molten salts(Pemsler, J. P Ed); The Electrochem Soc., Princeton 1976, 584 - 602

VARIABLES:

T/K = 508 - 603
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The melt used was an equimolar mixture of sodium nitrate - potassium nitrate. The solubilities of H_2 in the melt at various temperatures are:

T/K	10^7 K_H/mol cm^{-3} bar^{-1}
508	1.26
533	1.48
573	1.86
603	2.19

Smoothed Data:

The temperature dependence of the Henry's law constant, K_H, is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ bar}^{-1}) = -5.38 - 772/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.2% (compiler)

The heat of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kJ mol}^{-1} = 14$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -22 \quad \text{(at 533 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High sensitivity pressure measuring technique.

The diagram and details of the apparatus have been described elsewhere (1). A typical solubility measurement was performed as follows. The melt was evacuated at 10^{-5} bar for several hours for degassing. The vacuum was disconnected and hydrogen gas was introduced at one atm. The melt was vigorously stirred with a magnetic stirrer. The pressure variations were measured, with a high precision differential manometer, as a function of time until the equilibrium was attained. The amount of dissolved gas was calculated from the rapid initial pressure changes after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

High purity H_2 was used. It was freed from carbon dioxide impurities by keeping it in contact with Ascarite. The last traces of water were removed by adsorption on molecular sieves 5A (Carlo Erba, Milano) at -80°C. The final water content was <10 ppm. Reagent grade sodium and potassium nitrates were from Carlo Erba, Milano. The mixture was filtered in the molten state

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.

J. Electroanal. Chem. 1972, **38**, 373.

COMPONENTS: (1) Hydrogen; H_2; [1333-74-0] (2) Sodium hydroxide; NaOH; [1310-73-2] (3) Potassium hydroxide; KOH; [1310-58-3]	**ORIGINAL MEASUREMENTS:** Eluard, A. **Ph. D. Thesis, University of Paris** 1970. Cited in: Zambonin, P. G.; Desimoni, E.; Palmisano, F.; Sabbatini, L. in **Ionic Liquids** (Lovering, D.; Inman, D.; Eds.) Plenum 1980, 249 - 89.
VARIABLES: one temperature: T/K = 500 P/kPa: 101.325 (compiler)	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of hydrogen in molten NaOH - KOH (51 - 49 mol%) has been reported at one temperature:

T/K	10^8 Solubility/mol cm^{-3} atm^{-1}
500	2.24

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Coulometric method.

The coulometric method used was developed by Vogel and Smith (1).

SOURCE AND PURITY OF MATERIALS:

Not available.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Vogel, W. M.; Smith, S. W. **J. Electroanal. Chem.** 1968, **18**, 215.

COMPONENTS:

(1) Hydrogen; H_2; [1333-74-0]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]

ORIGINAL MEASUREMENTS:

Volgin, M. A.; L'vov, A. L.; Loskutkin, V. A.

Elektrokhim. 1973, **9**, 368 - 71.
Sov. Electrochem. 1973, **9**, 353 - 55.

VARIABLES:

P/kPa = 86.126
T/K = 783 - 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The Values of Henry's law constant, K_H, and the solubility of hydrogen in the molten binary eutectic Li_2CO_3 - Na_2CO_3 at different temperatures are:

t/°C	10^7 Solubility[a]/g-mole cm^{-3}	10^7 K_H[b]/mol cm^{-3} atm^{-1}
510	1.7	2.0
550	2.1	2.5
600	2.8	3.3
650	3.6	4.2
700	5.3	6.2

[a] P_{H_2} = 0.85 atm. [b] Calculated by the compiler.

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.278 - 1909.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.9% (compiler)

The enthalpy of solution, ΔH, is: ΔH/kJ mol^{-1} = 36.6 (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Displacement method.

The melt was saturated with the gas by passing a mixture of H_2 + CO_2 (17 : 3) containing 2 volume% water. The dissolved hydrogen was displaced with chromatographically pure CO_2. The liberated H_2 was collected in a buret over alkali solution.

SOURCE AND PURITY OF MATERIALS:

A mixture of H_2 + CO_2 (17 : 3) containing 2 vol.% water vapor was used. The CO_2 used was chromatographically pure.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS: (1) Hydrogen; H_2; [1333-74-0] (2) Sodium acetate; CH_3COONa; [127-09-3] (3) Potassium acetate; CH_3COOK; [127-08-2]	ORIGINAL MEASUREMENTS: Marassi, R.; Bartocci, V.; Gusteri, M.; Cescon, P. **J. Appl. Electrochem.** 1978, 9, 81 - 87.
VARIABLES: P/kPa = 10^2 T/K = 529.6 - 573.3	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of H_2 in molten eutectic mixture CH_3COONa - CH_3COOK (46.3 - 53.7 mol%) at different temperatures are:

T/K	10^7 $K_H{}^a$/mol cm^{-3} atm^{-1}	10^6 K_H/mol m^{-3} Pa^{-1}
529.6	3.29	3.25
547.6	3.43	3.39
565.9	3.74	3.69
573.3	3.76	3.71

[a] Calculated by the compiler.

Smoothed Data:
Temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.659 - 437.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.6% (compiler)

The enthalpy of solution, ΔH, and the entropy of solution, ΔS, are:

ΔH/kJ mol^{-1} = 8.2 ΔS/J K^{-1} mol^{-1} = -19.8 (at 523 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The apparatus used for gas solubility measurements was essentially the same as described earlier (1). A modified form of the mercury manometer was employed. The method of calibration of the apparatus and calculating the solubility from pressure readings was the same as reported in (2).

SOURCE AND PURITY OF MATERIALS:

Reagent grade CH_3COONa and CH_3COOK supplied by Carlo Erba (Milan) were used without further treatment.

High purity hydrogen and nitrogen were dried with type 5A molecular sieves.

ESTIMATED ERROR:

solubility = 5 - 7%

REFERENCES:

1. Marassi, R.; Bartocci,V.; Pucciarelli, F.; Cescon, P. **J. Electroanal. Chem.** 1973, 47, 509.
2. Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, 69, 2014.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen; H_2; [1333-74-0] (2) Deuterium; D_2; [7782-39-0] (3) Dilithium beryllium fluoride; Li_2BeF_4	Malinauskas, A. P.; Richardson, D. M. **Ind. Eng. Chem. Fundam.** 1974, 13, 242 - 245.
VARIABLES:	**PREPARED BY:**
P/kPa = 101.325 - 202.650 T/K = 773 - 973	N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of hydrogen and deuterium were determined at different temperatures. Considering the results for H_2 and D_2 solubilities to be identical, the values of Henry's law constant, K_H, and Ostwald coefficient, K_C, are:

T/K	10^8 $K_H^{a,b}$/mol cm^{-3} atm^{-1}	10^3 K_C^a
773	2.02 ± 0.24	1.28 ± 0.15
873	4.17 ± 0.29	2.99 ± 0.21
973	5.08 ± 0.56	4.06 ± 0.45

[a] H_2 and D_2 results considered identical.
[b] Calculated by the compiler using the relation $K_H = K_C/RT$.

Smoothed Data:

Temperature dependence of K_H and K_C are expressed by the equations:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.6825 - 1535/(T/K)$$

$$\log K_C = -0.3948 - 1910.7/(T/K) \quad \text{(compiler)}$$
$$\text{std. dev.} = 7.5\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

ΔH/kcal mol^{-1} = 7.02 ± 1.80 $\quad$ $\Delta S°$/eu = -3.5 ± 2.1 (at 1000 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Stripping method. The diagram and details of the apparatus and the experimental procedure are described in (1). In brief, the melt was saturated with the gas and a known volume of the saturated melt was transferred to the stripper. The dissolved gas was freed by sparging with xenon and analyzed by mass spectroscopy.	Hydrogen and xenon were at least 99.9% pure. Deuterium was 99.7% pure. Hydrogen and deuterium were purified by passing through coils of copper tubing cooled in liquid nitrogen.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:
	1. Malinauskas, A. P.; Richardson, D. M.; Savolainen, J. E.; Shaffer, J. H. **Ind. Eng. Chem. Fundam.** 1972, 11, 584.

COMPONENTS:

(1) Hydrogen; H_2; [1333-74-0]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]
(4) Potassium carbonate; [584-08-7]

ORIGINAL MEASUREMENTS:

Volgin, M. A.; L'vov, A. L.
Issled. Obl. Khim. Istochnikov Toka <u>1971</u>, 2, 26 - 31.

Chem. Abstr. <u>1973</u>, **78**, 487.

VARIABLES:

$T/K = 873$
$P/kPa = 101.325$ (1 atm)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The value of Henry's law constant, K_H, for the solubility of H_2 in molten eutectic Li_2CO_3 - Na_2CO_3 - K_2CO_3 is:

$t/°C$	$10^6\ K_H/mol\ cm^{-3}\ atm^{-1}$
600	18

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Electrochemical method.

SOURCE AND PURITY OF MATERIALS:

Not available.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Deuterium, D_2, [7782-39-0]

(2) Dilithium beryllium fluoride; Li_2BeF_4

ORIGINAL MEASUREMENTS:

Malinauskas, A. P.; Richardson, D. M.

Ind. Eng. Chem. Fundam. 1974, 13, 242 - 245.

VARIABLES: P/kPa = 101.325 - 202.650

T/K = 773 - 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, and the Ostwald coefficient, K_C, for the solubility of deuterium in molten Li_2BeF_4 at different temperatures are:

T/K	10^8 $K_H^{a,b}$/mol cm^{-3} atm^{-1}	10^3 K_C^a
773	2.22 ± 0.13	1.41 ± 0.08
873	2.82 ± 0.22	2.74 ± 0.16
973	5.33 ± 0.55	4.26 ± 0.44

[a] Includes H_2 and HD also collected.

[b] Calculated by the compiler using the relation $K_H = K_C/RT$.

Smoothed Data:

Temperature dependence of K_H and K_C are expressed by the equations:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.875 - 1399.4/(T/K) \quad \text{(compiler)}$$
$$\text{std. dev.} = 8.8\% \quad \text{(compiler)}$$

$$\log K_C = -0.5008 - 1811.8/(T/K) \quad \text{(compiler)}$$
$$\text{std. dev.} = 1.7\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is calculated to be:

$$\Delta H/\text{kJ mol}^{-1} = 34.7 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The diagram and details of the apparatus and the experimental procedure are described in (1). In brief, the melt was saturated with deuterium and a known volume of the saturated melt was transferred to the stripper. The dissolved deuterium was freed by sparging with xenon and analyzed by mass spectroscopy.

SOURCE AND PURITY OF MATERIALS:

Deuterium was 99.7% pure and xenon was at least 99.9% pure. Deuterium was purified by passing through coils of copper tubing cooled in liquid nitrogen.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Malinauskas, A. P.; Richardson, D. M.; Savolainen, J. E.; Shaffer, J. H. **Ind. Eng. Chem. Fundam.** 1972, 11 584.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Frame, J. P.; Rhodes, E.; Ubbelohde, A. R.

Trans. Faraday Soc. 1961, 57, 1075 - 77.

VARIABLES:

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

No depression in freezing point of the solvent was observed from the solubility of oxygen at atmospheric pressure. This indicated that oxygen solubility in molten sodium nitrate was less than 10^{-4} mole/mole of salt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopy.

SOURCE AND PURITY OF MATERIALS:

Oxygen from commercial cylinder (B.O.C.) was dried by passing through a liquid air trap.

Sodium nitrate containing less than 0.0003% cation and less than 0.001% of anion impurities was dried for several days at 240°C followed by the thermal shock technique (1). Drying was completed by evacuating the system after melting the salt.

ESTIMATED ERROR:

Freezing point was measured within ± 0.02°C

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R.

Proc. Royal Soc. A 1959, 251A 156.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Potassium nitrate; KNO_3; [7757-79-1]	Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075 - 77.
VARIABLES: P/kPa: 101.325 (1 atm.)	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

No depression in freezing point of the solvent was observed from the solubility of oxygen at atmospheric pressure. This indicated that oxygen solubility in molten potassium nitrate was less than 10^{-4} mole/mole of salt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopy.

SOURCE AND PURITY OF MATERIALS:

Oxygen from commercial cylinder (B.O.C.) was dried by passing through a liquid air trap.

Potassium nitrate containg less than 0.0003% of cation and less than 0.001% of anion impurities was dried for several days at 240°C followed by the thermal shock technique (1). Drying was completed by evacuating the system after melting the salt.

ESTIMATED ERROR:

Freezing point was measured within ± 0.02°C

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R.

   Proc. Royal Soc. A 1959, 251A, 156.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cesium nitrate; $CsNO_3$; [7789-18-6]

ORIGINAL MEASUREMENTS:

Frame, J. P.; Rhodes, E.; Ubbelohde, A. R.

Trans. Faraday Soc. 1961, 57, 1075 - 77.

VARIABLES:

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

No depression in freezing point of the solvent was observed from the solubility of oxygen at atmospheric pressure. This indicated that oxygen solubility in molten cesium nitrate was less than 10^{-4} mole/mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopy.

SOURCE AND PURITY OF MATERIALS:

Oxygen from commercial cylinder (B.O.C.) was dried by passing through a liquid air trap.

Cesium nitrate containing less than 0.1% of all impurities was dried at 240°C for many days followed by the thermal shock technique (1). Drying was completed by evacuating the system after melting the salt.

ESTIMATED ERROR:

Freezing point was measured within ± 0.02°C

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R.

Proc. Royal Soc. A 1959, 251A, 156.

COMPONENTS:

(1) Oxygen; O_2, [7782-44-7]

(2) Lithium carbonate; Li_2CO_3; [554-13-2]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, **127**, 1655 - 59.

VARIABLES:

$T/K = 1048 - 1098$

$P/kPa = 10.133 - 40.530$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of oxygen in molten Li_2CO_3 at different temperatures are:

t/°C	P_{CO_2}/atm	$10^4\ K_H{}^a$/mol cm^{-3} atm^{-1}
775	0.10	1.68 ± 0.18
800	0.20	5.92 ± 0.25
825	0.40	10.30 ± 0.38

[a] Data refer to both physically and chemically dissolved oxygen in the melt.

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = 10.624 - 18191/(T/K) \quad \text{(compiler)}$$

std. dev. = 11.8% (compiler)

The heat of solution, ΔH, for the solubility of oxygen in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 206$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and procedure followed are described in the original paper. In brief, the melt was saturated by bubbling the gas for 2 - 3 hr. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent determinations were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Sodium carbonate; Na_2CO_3; [497-19-8]

ORIGINAL MEASUREMENTS:

Andresen, R. E.

J. Electrochem. Soc.. 1979, 126, 328 - 34.

VARIABLES:

one temperature: T/K = 1045
P/kPa = 93.459

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility, C_1, of O_2 in molten Na_2CO_3 is reported to be:

t/°C	P_{O_2}/torr	10^6 C_1/mol cm^{-3}
872	701	2.35 ± 0.40

Henry's law is not obeyed; instead a mechanism of reaction between O_2 and Na_2O in the melt to form NaO_2 and Na_2O_2 has been proposed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The diagram and details of the apparatus used are given in the original publication. The procedure followed has been described in detail elsewhere (1). In brief, the apparatus was first evacuated and then filled with oxygen to a pressure of about 1 atm. Due to gas dissolution, the gas pressure dropped. Equilibrium was attained when the pressure did not alter for about 1 hr. The volume of gas dissolved was determined from the initial and final positions of the mercury meniscus in the manometer. The apparatus was earlier calibrated using argon. With a cathetometer, pressure changes as small as 0.05 torr could be read.

SOURCE AND PURITY OF MATERIALS:

Extra dry O_2 (99.6%) was used directly from the cylinder.

Reagent grade Na_2CO_3 supplied by Baker was dried at about 200°C in an oven, and then in the furnace at about 400°C under CO_2 pressure of 100 torr for about a day.

ESTIMATED ERROR:

solubility: ± 20 - 30%

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A. **Proceedings of the 4th Nordic High Temperature Symposium, Vol. 1 (Tilli, M.; Editor), Helsinki** 1975, 127.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Oxygen; O_2; [7782-44-7] (2) Sodium sulfate; Na_2SO_4; [7757-82-6]	Andresen, R. E. **J. Electrochem. Soc.** 1979, **126**, 328 - 34.
VARIABLES:	PREPARED BY:
$T/K = 1173 - 1359$ $P/kPa = 53.329 - 101.325$	N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of oxygen in molten sodium sulfate at different temperatures are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
903	1.90 ± 0.20
964	2.63 ± 0.08
1015	3.0 ± 0.7
1075	5.42 ± 0.03

Smoothed Data:

Temperature dependence of K_H for the solubility of oxygen in molten Na_2SO_4 is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.093 - 3088.2/(T/K)$$

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, of solution are:

$$\Delta H°/\text{kJ mol}^{-1} = 59.1$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = 17.0 \quad (\text{at } 1173\text{ K})$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The diagram and details of the apparatus used are given in the original paper. The procedure followed has been described in detail elsewhere (1). Briefly, the apparatus was first evacuated and then filled with the gas to a pressure of about 1 atm.

Due to gas dissolution, the gas pressure dropped. Equilibrium was attained when the pressure did not change for about 1 hr. The volume of the gas dissolved was determined from the initial and final positions of the mercury meniscus in the manometer. The apparatus was earlier calibrated using argon. With a cathetometer, pressure changes as small as 0.05 torr could be read.

SOURCE AND PURITY OF MATERIALS:

Extra dry oxygen (99.6%) was used directly from the cylinder.

Reagent grade Na_2SO_4 supplied by Matheson, Coleman and Bell was dried in an oven at about 200°C, then in the furnace at about 400°C under vacuum.

ESTIMATED ERROR:

solubility: ± 20 - 30%

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H.A. **Proceedings of the 4th Nordic High Temperature Symposium, Vol. 1, (Tilli, M.; Editor), Helsinki** 1975 127.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium nitrate; $LiNO_3$
[7790-69-4]
(3) Potassium nitrate; KNO_3;
[7757-79-1]

ORIGINAL MEASUREMENTS:

Yurkinskii, V. P.; Aganesova, S. B.; Morachevskii, A. G.; Zagrivnyi, V. N.

Zh. Prikl. Khim. 1974, **47**, 1527 - 31; **J. Appl. Chem. U.S.S.R.**(Eng. Transl.) 1974, **47**, 1569 - 72.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 428 - 583

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of oxygen in the molten eutectic $LiNO_3$ - KNO_3 at 1 atm. oxygen partial pressure at various temperatures are reported to be:

t/°C	10^4 C_1/mol liter^{-1}
155	1.90
190	3.74
210	4.65
255	7.89
310	13.60

Smoothed Data:

Temperature dependence of solubility is expressed by the relation:

$$\log(C_1/\text{mol ml}^{-1}) = -3.540 - 1351.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.4% (compiler)

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = 26.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oscillographic voltammetry.

SOURCE AND PURITY OF MATERIALS:

Lithium nitrate (cp) was dehydrated by heating in air for 8 - 10 hr. while the temperature was raised slowly to 300 - 350 °C. It was kept at 350°C till the evolution of water stopped and then kept in a dessicator over P_2O_5. The $LiNO_3$ - KNO_3 mixture was dried by purging the melt with dried argon at 400°C and finally by addition of metallic sodium.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Electroanal. Chem.** 1972, 38, 373 - 79.
2. Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1972, **68**, 2083 - 89.

VARIABLES:

$T/K = 511 - 603$
$P/kPa = 10^2$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solvent employed was an equimolar molten mixture of sodium nitrate - potassium nitrate. The solubilities of oxygen in the melt at various temperatures are:

T/K	$10^8\ K_H$/mol cm^{-3} atm^{-1}	$10^6\ C_1$/mol kg^{-1} atm^{-1}
511	0.9	4.6
533	1.0	5.3
555	1.2	6.4
587	1.55	8.1
603	1.6	8.4

Smoothed Data:

Temperature dependence of Henry's law constant and solubility are given by the relations:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -6.286 - 904.6/(T/K) \quad \text{(compiler)}$$

$$\log(C_1/\text{mol kg}^{-1}\text{ atm}^{-1}) = -3.528 - 925.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.6% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kJ mol}^{-1} = 17.6 \pm 0.8$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -31 \quad \text{(at 533 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High sensitivity pressure measuring technique.

The diagram and details of the apparatus and procedure employed for solubility measurements are described in the original paper. Briefly, the melt was evacuated at 10^{-5} bar for several hours for degassing. The vacuum was disconnected and oxygen gas was introduced at one atm. The melt was vigorously stirred with a magnetic stirrer. The pressure variations were noted, using a mercury manometer, as a function of time until the equilibrium pressure was reached. The amount of gas dissolved was calculated from the rapid initial pressure changes after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

Oxygen (High Purity grade) was purified by keeping it in contact for several hours with Ascarite to remove CO_2 and other acidic impurities and with molecular sieves at -80°C to to remove moisture.

Reagent grade sodium and potassium nitrates were used. The solvent was purified and filtered in the molten state.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8]	N. P. Bànsal National Aeronautics snd Space Administration. Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Two independent studies (1,2) have been reported for the solubility of oxygen in molten Li_2CO_3 - Na_2CO_3 (53.3 - 46.7 mol%). Results of the two investigations are compared in Fig. 1, below. It is interesting to note, from Fig. 1, that results obtained by Schenke et al. (2) using an amperometric titration technique are in good agreement (within experimental precision) with the data of Appleby and Van Drunen (1) who employed a melt chilling method.

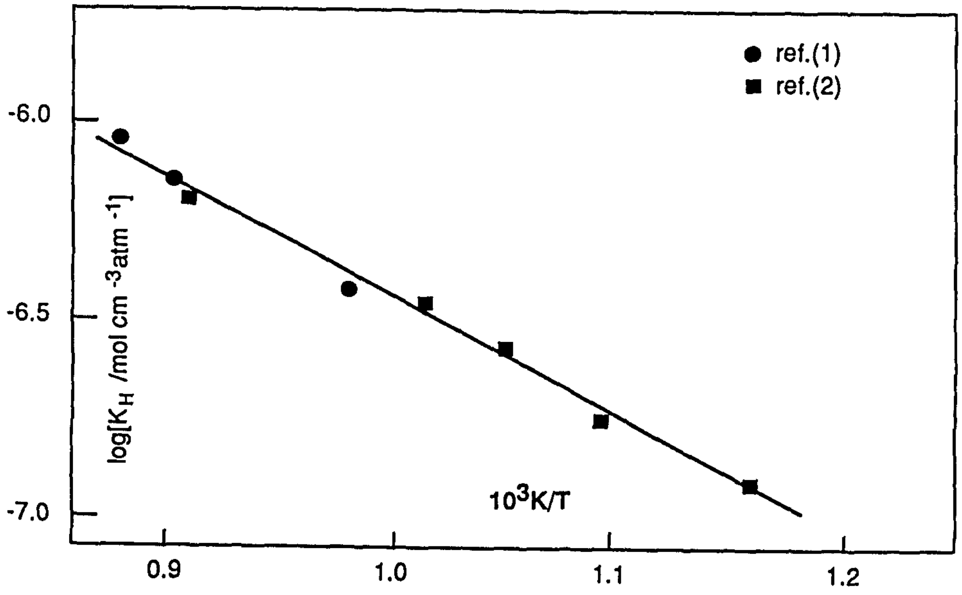


Fig 1.

The recommended numerical values, obtained by least-squares fitting of the two data sets (1,2), are given in Table 1.

continued

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

continued

Table 1

Recommended Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
860	1.05
880	1.27
900	1.52
920	1.81
940	2.14
960	2.52
980	2.94
1000	3.40
1020	3.92
1040	4.49
1060	5.12
1080	5.82
1100	6.57
1120	7.39

References:

1. Appleby, A. J.; Van Drunen, C. J. **Electrochem. Soc.** 1980, 127, 1655.

2. Schenke, M.; Broers, G. H. J.; Ketelaar, J. A. A. J. **Electrochem. Soc.** 1966, 113, 404.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

T/K = 1023 - 1123
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of oxygen in the melt Li_2CO_3 - Na_2CO_3 (53.3 - 46.7 mol%) at different temperatures are:

t/°C	P_{CO_2}/atm	$10^4 K_H{}^a$/mol dm^{-3} atm^{-1}
750	0.026	3.57 ± 0.61
800	0.06	5.57 ± 0.27
850	0.10	8.36 ± 0.46

[a] Data refer to both physical and chemical solubilities of oxygen in the melt.

Smoothed Data:
Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -2.296 - 4247.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.04% (compiler)

The heat of solution, ΔH, for the solubility of oxygen in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 83$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and procedure employed are described in the original paper. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A part of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]

ORIGINAL MEASUREMENTS:

Schenke, M.; Broers, G. H. J.; Ketelaar, J. A. A.

J. Electrochem. Soc. 1966, 113, 404.

VARIABLES:

T/K = 860 - 1060
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of O_2 in the melt Li_2CO_3 - Na_2CO_3 (53.3 - 46.7 mol%) at various temperatures are given only in graphical form. The values of K_H derived from the plot at different temperatures are:

T/K	10^7 K_H^a/mol cm^{-3} atm^{-1}
860	1.1
910	1.5
957	2.7
990	3.4
1066	4.8

[a] Values derived from the graph by the compiler.

Smoothed Data:

The temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -3.461 - 3014/(T/K) \quad \text{(compiler)}$$

std. dev. = 4.7% (compiler)

The heat of solution, ΔH, for the solubility of O_2 in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 62.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amperometric titration method. The melt was saturated with oxygen by bubbling an O_2 - CO_2 gas mixture of known composition. The dissolved oxygen was titrated by stepwise addition of solid Na_2SO_3 as reducing agent. During titration a cover of N_2 - CO_2 mixture was maintained while the partial pressure of CO_2 was kept constant. A pair of rotating platinum wire electrodes with a fixed potential difference maintained between them was used as an indicator. The current flowing through the system was the measure of the amount of oxygen dissolved in the melt.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Smith, S. W.; Vogel, W. M.; Kapelner, S.

J. Electrochem. Soc. 1982, 129, 1668 - 70.

VARIABLES:

one temperature: T/K = 923 ± 5
melt comp./mol% K_2CO_3 = 38.0

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Oxygen reacts with the carbonate melt resulting in the formation of superoxide and peroxide ions. Henry's law was not applicable due to the chemical reaction. The concentration of molecular oxygen in the melt was found to be negligible. The total equilibrium oxygen content in the melt, at different partial pressures of CO_2, were:

P_{O_2}/atm	P_{CO_2}/atm	$10^6\ C_1{}^a$/mol fraction
0.5	0.5	5.6
0.5	0.5	5.0
0.5	0.1	17.3
0.5	0.1	21.2
0.5	0.1	13.2
0.5	0.1	17.6
0.5	0.02	52.6
0.5	0.02	27.0
0.5	0.02	19.1
0.5	0.02	50.5
0.5	0.02	43.1

[a] Experimental value.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A diagram of the apparatus is given in the original paper. A known amount of the melt was allowed to equilibrate with a gas mixture of $CO_2 + O_2$. The system was then flushed with $CO_2 + N_2$ mixture of the same CO_2 partial pressure. An excess of finely powdered $Cr_2(SO_4)_3$ was then added to the melt which reacted with all forms of oxygen completely and rapidly. After 2 hr., the melt was frozen and Cr^{6+} content was estimated by spectrophotometric technique using s-diphenylcarbazide.

SOURCE AND PURITY OF MATERIALS:

Analytical grade melt components were used.

The gas mixtures were prepared by mixing "high purity" grade gases with a Matheson Model 8249 gas flow controller.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen; C.

J. Electrochem. Soc. 1980, **127**, 1655 - 59.

VARIABLES:

T/K = 973 - 1023
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of oxygen in the melt Li_2CO_3 - K_2CO_3 (42.7 - 57.3 mol%) at different temperatures are:

t/°C	P_{CO_2}/atm	$10^4\ K_H^{a}$/mol dm^{-3} atm^{-1}
700	0.026	4.18 ± 0.35
750	0.026	6.16 ± 0.19
800	0.06	14.00 ± 0.80
850	0.10	25.90 ± 1.60

[a] Data refer to both physically and chemically dissolved oxygen in the melt.

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -0.319 - 5945.4/(T/K) \quad \text{(compiler)}$$

std. dev. = 6.9% (compiler)

The heat of solution, ΔH, for the solubility of oxygen in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 120.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method.

The diagram and details of the apparatus used and procedure followed are described in the original paper. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A part of the saturated melt was transferred into the quenching compartment where it was slowly chilled to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Sodium carbonate; Na_2CO_3; [497-19-8]
(3) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

$T/K = 1048 - 1123$
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of oxygen in the melt Na_2CO_3 - K_2CO_3 (58 - 42 mol%) at different temperatures are:

t/°C	P_{CO_2}/atm	10^4 $K_H{}^a$/mol dm^{-3} atm^{-1}
775	0.10	13.11 ± 0.60
800	0.10	14.15 ± 0.88
850	0.10	23.53 ± 1.88

[a] Data refer to both physical and chemical solubilities of oxygen in the melt.

Smoothed Data:
Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -1.935 - 4161.3/(T/K) \quad \text{(compiler)}$$

std. dev. = 4.5% (compiler)

The heat of solution, ΔH, for the solubility of oxygen in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 79$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method.

The diagram and details of the apparatus used and procedure employed are described in the original publication. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2;[7782-44-7]

(2) Sodium oxide; Na_2O;[1313-59-3]

(3) Vanadium oxide; V_2O_5; [1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E. G.; Fedorov, A. A.; Ponomarev, V. E.
Zhur. Fiz. Khim. 1983, 57, 779-780;
Russ. J. Phys. Chem. (Eng. Transl.) 1983, 57, 478 - 479. (*).

VARIABLES:

T/K = 808 - 951
V_2O_5 / mole % = 55 - 70
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's Law Constants, K_p(mol cm^{-3} atm^{-1}), for the solubility of oxygen in Na_2O - V_2O_5 melts of various compositions were determined at different temperatures. Temperature dependence of K_p (mol cm^{-3} atm^{-1}), obtained by linear least squares fit, is given below as the coefficients of the equation log K_p = A + B/T ± Δ, where Δ is the error

mole % V_2O_5	Temp. range (K)	-A	-B	Δ
55.0	820 - 922	1.590	4348	0.039
61.0	808 - 903	3.017	2857	0.026
70.0	848 - 951	3.482	2273	0.041

The enthalpies (ΔH°) and entropies (ΔS°) of the solution were evaluated from the temperature dependence of the solubility constants expressed as $K_c = C_m/C_g$, where C_m and C_g are the volume concentrations of the dissolved gas in the liquid and the gas phase respectively, are given below:

mole % V_2O_5	ΔH°/kJ mol^{-1}	ΔS°/$JK^{-1}mol^{-1}$ (at 855K)
55.0	90.36	70.38
61.0	61.80	43.30
70.0	50.63	34.45

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas (helium) as well as by a gas - volumetric method. The discrepancy between the results of the two methods was 10 - 20 %.

The V_2O_5 content in the melt was determined by an amperometric titration.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Potassium Oxide; K_2O;
[12136-45-7]
(3) Vanadium Oxide; V_2O_5;
[1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E.G; Fedorov, A. A.;
Ponomarev; V. E.; Ketov, A. N.
Zhur. Fiz. Khim. <u>1982</u>, **56**, 474 - 475;
Russ. J. Phys. Chem. (Eng.Transl.)
<u>1982</u>, **56**, 292 - 293. (*).

VARIABLES:

T/K = 773 - 909
V_2O_5/mol% = 50 - 66.5
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of oxygen in K_2O - V_2O_5 melts of various compositions were determined at various temperatures at an initial pressure of 1 atm. The average solubilities obtained from five measurements at each temperature are given below :

50.0 mole % V_2O_5		55.5 mole % V_2O_5		61.0 mole % V_2O_5		66.5 mole % V_2O_5	
T/K	10^7 c_m/mol cm^{-3} atm^{-1}	T/K	10^7 c_m/mol cm^{-3} atm^{-1}	T/K	10^7c_m/mol cm^{-3} atm^{-1}	T/K	10^7c_m/mol cm^{-3} atm^{-1}
798	1.05	778	1.54	773	3.13	783	7.41
818	1.41	799	1.70	813	3.72	810	8.91
848	2.04	816	2.34	823	4.68	837	8.71
893	3.39	858	3.16	853	5.37	873	12.30
		898	4.27	893	7.41	909	13.80

(Cont.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

<u>Desorption Method</u> : Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas using a standard method. The oxygen content in the gas mixture was estimated by analysis based on thermal conductivity.
<u>Volumetric Method</u>: Recrystallized potassium metavanadate and vanadium pentoxide were fused together. The possible reducing impurities present in the melt were oxidized for 3h. at 550°C. The dissolved oxygen was removed by bubbling helium through the melt for 30 min. The discrepancy between the solubilities determined by the two methods was ±10 %.

SOURCE AND PURITY OF MATERIALS:

Potassium metavanadate of "chemically pure" grade was recrystallized. Vanadium pentoxide of "specially pure" grade was used.

ESTIMATED ERROR:

Solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2;[7782-44-7]

(2) Potassium Oxide; K_2O;
[12136-45-7]
(3) Vanadium oxide; V_2O_5;
[1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E. G.; Fedorov, A. A.;
Ponomarev, V. E.
Zhur. Fiz. Khim. 1983, **57,** 779-780;
Russ. J. Phys. Chem. (Eng. Transl.)
1983, 57, 478 - 479. (*).

VARIABLES:

T/K = 773 - 909
V_2O_5 / mole % = 50 - 66.5
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's Law Constants, K_p(mol cm^{-3} atm^{-1}), for the solubility of oxygen in K_2O_5 - V_2O_5 melts of various compositions were determined at different temperatures. Coefficients of the equation log K_p = A+B/T ± Δ, where Δ is the error obtained by linear least squares fit of the data are given below:

mole % V_2O_5	Temp. range (K)	-A	-B	Δ
50.0	798 - 893	2.341	3689	0.043
55.5	778 - 898	3.251	2783	0.026
61.0	773 - 893	3.496	2214	0.015
66.5	783 - 909	4.345	1393	0.021

The enthalpies (ΔH°) and entropies (ΔS°) of the solution were evaluated from the temperature dependence of the solubility constants expressed as $K_o = C_m/C_g$, where C_m and C_g are the volume concentrations of the dissolved gas in the liquid and the gas phase respectively, are given below:

mole % V_2O_5	ΔH°/kJ mol^{-1}	ΔS°/$JK^{-1}mol^{-1}$ (at 855K)
50.0	77.76	57.10
55.0	60.41	38.81
61.0	49.51	31.03
66.5	34.76	19.13

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas (helium) as well as by a gas - volumetric method.
The discrepancy between the results of the two methods was 10 - 20 %.

The V_2O_5 content in the melt was determined by an amperometric titration.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]

(2) Cesium oxide; Cs_2O;[20281-00-9]

(3) Vanadium oxide; V_2O_5;
[1314-62-1]

ORIGINAL MEASUREMENTS:

Nalimova, E. G.; Federov, A. A.; Ponomarev, V. E.
Zhur. Fiz. Khim. 1983, 57, 779-780;
Russ. J. Phys. Chem. (Eng. Transl.) 1983, 57, 478 - 479. (*).

VARIABLES:

T/K = 673 - 922
V_2O_5 / mole % = 55 - 70
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry Constants, K_p(mol cm^{-3} atm^{-1}), for the solubility of oxygen in Cs_2O - V_2O_5 melts of various compositions were determined at different temperatures. Coefficients of the equation $\log K_p = A + B/T + \Delta$, where Δ is the error, obtained by linear least squares fit of the data are given below:

Melt composition mole % V_2O_5	Temp. range (K)	-A	-B	Δ
55.0	832 - 922	3.402	2539	0.049
61.0	673 - 825	3.703	1800	0.011
70.0	770 - 879	4.209	1300	0.009

The enthalpies ($\Delta H°$) and entropies ($\Delta S°$) of solution evaluated from the temperature dependence of the solubility constants expressed as $K_c = C_m/C_g$, where C_m and C_g are the volume concentrations of the dissolved gas in the liquid and the gas phase respectively, are given below:

Melt composition/mole % V_2O_5	$\Delta H°$/kJ mol^{-1}	$\Delta S°$/J$K^{-1}$$mol^{-1}$ (at 855K)
55.0	55.72	35.98
61.0	46.34	30.20
70.0	32.00	20.32

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined by desorption of the dissolved gas from the melt by an inert gas (helium) as well as by a gas - volumetric method. The discrepancy between the results of the two methods was 10 - 20 %.

The V_2O_5 content in the melt was determined by an amperometric titration.

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Sodium carbonate; Na_2CO_3; [497-19-8]
(3) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

T/K = 1073 - 1123
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of oxygen in the melt Na_2CO_3 - NaCl (60 - 40 mol%) at different temperatures are:

t/°C	$10^4\ K_H{}^a$/mol dm^{-3} atm^{-1}
800	20.64 ± 1.31
850	29.15 ± 1.70

[a] Data refer to both physically and chemically dissolved oxygen in the melt.

Smoothed Data:

The heat of solution, ΔH, for the solubility of oxygen in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 70$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and procedure followed are described in the original publication. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent determinations were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

solubility: ± 20%

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Potassium sulfate; K_2SO_4; [7778-80-5]
(3) Potassium bisulfate; $K_2S_2O_7$; [7646-93-7]

ORIGINAL MEASUREMENTS:

Comtat, M.; Vothi, N. D.

J. Chim. Phys. 1976, 73, 109 - 12.

VARIABLES:

one temperature: T/K = 698
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of oxygen in the molten K_2SO_4 - $K_2S_2O_7$ (saturated by sulfate) mixture at 1 atmosphere gas pressure is:

t/°C	10^7 C_1/mol cm^{-3}
425	4.4 ± 0.2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Constant potential electrolysis.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8] (4) Potassium carbonate; K_2CO_3; [584-08-7]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989

CRITICAL EVALUATION:

Two independent investigations (1,2) are available for the solubility of oxygen in molten Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%). Results of these two studies are compared in Fig. 1. It is interesting to note that results of Schenke et al. (2), obtained by using an amperometric titration method, are in good agreement (within experimental precision) with the data of Appleby and Van Drunen (1) who employed the melt chilling technique.

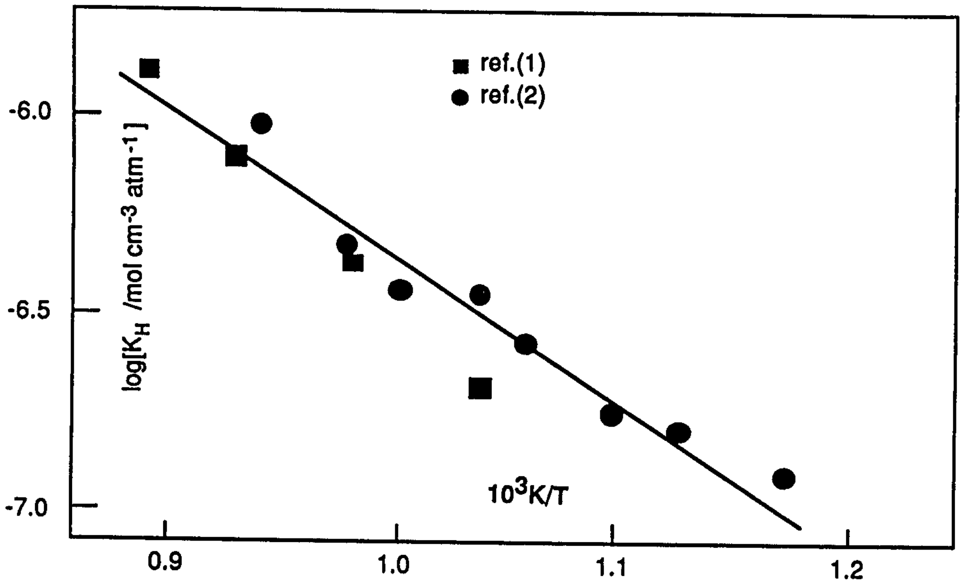


Fig 1.

The recommended numerical values, obtained by least-squares fitting of the two data sets (1,2) are given in Table 1.

continued

COMPONENTS:	EVALUATOR:
(1) Oxygen; O_2; [7782-44-7] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8] (4) Potassium carbonate; K_2CO_3; [584-08-7]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Table 1

Recommended Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
860	1.11
880	1.40
900	1.75
920	2.17
940	2.66
960	3.24
980	3.91
1000	4.69
1020	5.58
1040	6.59
1060	7.74
1080	9.04
1100	10.49
1120	12.11

References:

1. Appleby, A. J.; Van Drunen, C. J. **Electrochem. Soc.** 1980, 127, 1655.

2. Schenke, M.; Broers, G. H. J.; Ketelaar, J. A. A. J. **Electrochem. Soc.** 1966, 113, 404.

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]
(4) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Schenke, M.; Broers, G. H. J.; Ketelaar, J. A. A.

J. Electrochem. Soc. 1966, 113, 404.

VARIABLES:

T/K = 850 - 1069
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of O_2 in the melt Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%) at different temperatures are given only in graphical form. The values of K_H derived from the plot at different temperatures are:

T/K	10^7 $K_H{}^a$/mol cm^{-3} atm^{-1}
852	1.25
886	1.60
913	1.86
945	2.81
972	3.95
1002	4.25
1023	5.22
1069	10.40

[a] Values derived from the graph by the compiler.

Smoothed Data:

The temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -2.602 - 3716.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 6.2% (compiler)

The heat of solution, ΔH, for the solubility of O_2 in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 74.1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Amperometric titration method. The melt was saturated with oxygen by bubbling an O_2 - CO_2 gas mixture of known composition. The dissolved oxygen was titrated by adding stepwise solid Na_2SO_3 as reducing agent. During titration a cover of N_2 - CO_2 mixture was maintained while the partial pressure of CO_2 was kept constant. A pair of rotating platinum wire electrodes with a fixed potential difference maintained between them was used as an indicator. The current flowing through the system was the measure of the amount of oxygen dissolved in the melt.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]
(4) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

T/K = 973 - 1123
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of O_2 in the melt Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%) at different temperatures are:

t/°C	P_{CO_2}/atm	10^4 K_H^a/mol dm^{-3} atm^{-1}
700	0.026	2.52 ± 0.24
750	0.026	5.10 ± 0.08
800	0.06	8.47 ± 0.22
850	0.10	15.10 ± 0.53

[a] Data refer to both physically and chemically dissolved oxygen in the melt.

Smoothed Data:

Temperature dependence of K_H for the solubility of oxygen in the melt can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -0.851 - 5586.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.8% (compiler)

The heat of solution, ΔH, for the solubility of oxygen in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 106.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method.

The diagram and details of the apparatus used and procedure employed have been described in the original publication. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A part of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Oxygen; O_2; [7782-44-7]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silicon dioxide; SiO_2; [7631-86-9]
(4) Alumina; Al_2O_3; [1344-28-1]

ORIGINAL MEASUREMENTS:

Sasabe, M; Kinoshita, Y.
J. Iron Steel Inst. Jpn. 1978, **64**, 1313 - 1322.

VARIABLES:

T/K = 1600 - 1785
P/kPa = 20.265 - 101.325

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The temperature dependence of the oxygen gas solubility, C(mol $cm^{-3} atm^{-1}$), in CaO - SiO_2 - Al_2O_3 melts of three different compositions are given by the following expressions.

$25CaO - 65SiO_2 - 10Al_2O_3$ (wt%)

$$C/\text{ mol cm}^{-3}\text{ atm}^{-1} = 6.7 \times 10^{-10} \exp\left[\frac{44000}{RT}\right]$$

$40CaO - 40SiO_2 - 20Al_2O_3$ (wt%)

$$C/\text{ mol cm}^{-3}\text{ atm}^{-1} = 2.9 \times 10^{-13} \exp\left[\frac{-10000}{RT}\right]$$

$45CaO - 40SiO_2 - 15Al_2O_3$ (wt%)

$$C/\text{ mol cm}^{-3}\text{ atm}^{-1} = 1.3 \times 10^{-13} \exp\left[\frac{6000}{RT}\right]$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Oxygen solubilities in the melt were estimated from the permeability and diffusivity of the gas.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Green, W. J. **Ph. D. Thesis**, Virginia Polytechnic Institute <u>1969</u>.

Green, W. J.; Field, P. E. **J. Phys. Chem.** <u>1980</u>, **84**, 3111 - 3114.

VARIABLES:

T/K = 536 - 611

P/kPa = 50.663 - 151.988

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of N_2 in molten $LiNO_3$, at different temperatures, are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
536	1.66
541	1.73
553	1.68
554	1.78
565	1.76
567	1.87
570	1.74
586	1.91
589	1.89
611	2.10

Smoothed Data:

The temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -6.04 - 397.0/(T/K)$$

std. dev. = 0.27% (authors)

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kcal mol}^{-1} = 1.82 \pm 0.18$$

$$\Delta S/\text{cal K}^{-1}\text{ mol}^{-1} = -6.23 \pm 0.32 \quad \text{(at 581 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the gas solubility apparatus are given in the original publication.

After saturating the melt with nitrogen gas, the gas phase was evacuated. Helium gas was introduced into the system as eluting gas to approximately 1 atm. The resultant gas mixture of nitrogen and helium was analyzed with an Aerograph 90 - P gas chromatograph (Varian).

SOURCE AND PURITY OF MATERIALS:

Dry nitrogen and helium obtained from Airco were used directly from the tanks.

Reagent grade lithium nitrate from Baker was used without further purification.

ESTIMATED ERROR:

$\delta C/P = \pm 5\%$ (authors)

REFERENCES:

COMPONENTS: (1) Nitrogen; N_2; [7727-37-9] (2) Lithium nitrate; $LiNO_3$; [7790-69-4]	**ORIGINAL MEASUREMENTS:** Cleaver, B.; Mather, D. E. **Trans. Faraday Soc.** 1970, **66**, 2469 - 82.
VARIABLES: one temperature: T/K = 550 P/kPa = 25000 - 98000	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of nitrogen in the melt are presented at only one temperature, in the graphical form as a function of the gas pressure in the range 250 - 980 bar. The value of the Henry's law constant, K_H, at the experimental temperature is:

t/°C	10^7 K_H/mol ml^{-1} bar^{-1}
277	0.73 ± 0.10

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original paper. The melt was saturated by stirring it in contact with the gas at high pressure. A sample of the saturated melt was isolated and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Nitrogen (99.9%) from British Oxygen Company was used without further purification or drying.

Lithium nitrate (99.9%) obtained from Johnson - Matthey & Co. was recrystallized from distilled water and dried at 120°C. It was stored in an air oven at 100°C.

ESTIMATED ERROR:

δP/bar = ± 10

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Nitrogen; N_2; [7727-37-9] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Four investigations have been reported for the solubility of nitrogen in molten sodium nitrate. One of these studies (1) which uses a cryometric method is only of preliminary nature. Copeland and Seibles (2) use a manometric technique whereas Field and Green (3) and Cleaver and Mather (4) employ an elution process.

Results of the three different studies have been compared below:

T/K	$10^7 K_H$/mol cm^{-3} atm^{-1}		
	Field & Green	Cleaver & Mather	Copeland & Seibles
600	2.0	(0.48)	(23)
640	2.3	0.59	20
680	(2.6)	0.70	17
720	(2.9)	0.82	15

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

The solubility results of Field and Green (3) are about an order of magnitude smaller than those reported by Copeland and Seibles (2) and about four - five times larger than those of Cleaver and Mather (4). The heat of solution reported by Copeland and Seibles is negative in contrast to the other two studies which report positive values. It has been pointed out by Copeland and Christie (5) that solubility results reported earlier from their laboratory are not reliable.

Further studies are needed in order to make a reliable evaluation of this system.

References:

1. Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075.
2. Copeland, J. L.; Seibles, L. **J. Phys. Chem.** 1966, 70, 1811.
3. Field, P. E.; Green, W. J. **J. Phys. Chem.** 1971, 75, 821.
4. Cleaver, B.; Mather, D. E. **Trans. Faraday Soc.** 1970, 66, 2469.
5. Copeland, J. L.; Christie, J. R. **J. Phys. Chem.** 1971, 75, 103.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Field, P. E.; Green, W. J.
J. Phys. Chem. 1971, 75, 821 - 5.

Green, W. J. **Ph. D. Thesis**, Virginia Polytechnic Institute 1969.

VARIABLES:

$T/K = 586 - 639$

$P/kPa = 95.246 - 125.643$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed over the pressure range studied (0.94 - 1.24 atm). The values of Henry's law constant, K_H, at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
586	1.886
587	1.853
601	1.958
605	2.096
615	2.024
620	2.218
623	2.356
625	2.190
639	2.096

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.71 - 599.2/(T/K)$$

std. dev. = 0.83%

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kcal mol}^{-1} = 2.74 \pm 0.83$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -4.54 \pm 1.36 \quad \text{(at 637 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram of the gas solubility apparatus is given in the original paper.

After saturating the melt with nitrogen gas, the gas phase was evacuated. Helium was introduced into the system as eluting gas to approximately 1 atm. pressure. The resultant gas mixture of nitrogen and helium was analyzed with an Aerograph Model 90-P gas chromatograph (Varian). Average of four measurements was used for calculation of the gas solubility.

SOURCE AND PURITY OF MATERIALS:

Dry nitrogen obtained from Airco was used directly from the tank.

Baker's reagent grade sodium nitrate was used without further purification.

ESTIMATED ERROR:

$\delta C/P = \pm 0.05$ (authors)

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Cleaver, B.; Mather, D. E.

Trans. Faraday Soc. 1970, **66**, 2469 - 82.

VARIABLES:

$T/K = 604 - 722$

$P/kPa = 0 - 10^5$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities in the melt at three temperatures are presented as a function of gas pressure in the range 280 - 1000 bar in graphical form only. The values of the Henry's law constant, K_H, at three temperatures are given as:

t/°C	$10^7\ K_H/\text{mol ml}^{-1}\ \text{bar}^{-1}$
331	0.50 ± 0.15
390	0.64 ± 0.15
449	0.84 ± 0.15

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{bar}^{-1}) = -5.931 - 829.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.3% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, and the partial molar volume, $\bar{V}_a$, of the dissolved gas are:

$$\Delta H/\text{kJ mol}^{-1} = 16.0$$

$$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -23.6$$

$$\bar{V}_a/\text{ml mol}^{-1} = 46 \pm 40$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High pressure elution technique.

Diagram and details of the apparatus are given in the original publication. The melt was saturated by stirring it in contact with the gas at high pressure. A part of the saturated melt was isolated and analyzed by the elution technique.

SOURCE AND PURITY OF MATERIALS:

Nitrogen (99.9%) from British Oxygen Company was used without further purification.

Sodium nitrate (B. D. H.) A. R. grade was purified by filtration through Pyrex frits in the molten state. The melt was allowed to freeze and stored under vacuum.

ESTIMATED ERROR:

$\delta P/\text{bar} = \pm 10$

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Seibles, L.

J. Phys. Chem. 1966, 70, 1811 - 15.

VARIABLES:

T/K = 628 - 727

P/kPa = 14185.5 - 43164.5

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The value of Henry's law constant, K_H, and gas solubilities, C_1, at different temperatures and gas pressures are:

P atm	10^7 K_H mol cm^{-3} atm^{-1}	10^4 C_1 mol cm^{-3}	P atm	10^7 K_H mol cm^{-3} atm^{-1}	10^4 C_1 mol cm^{-3}
	T = 727 K			T = 696 K	
364	16.5	6.00	349	16.0	5.57
286	14.0	4.00	272	16.0	4.34
227	13.7	3.11	217	14.9	3.24
167	16.4	2.73	159	17.9	2.85
	T = 718 K			T = 686.5 K	
357	16.7	5.97	426	17.4	7.40
281	15.0	4.21	341	17.4	5.93
223	15.1	3.37	266	17.5	4.66
163	18.3	2.98	213	15.5	3.31
			155	18.8	2.91

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The apparatus and technique were the same as described by Copeland and Zybko (1). Known quantities of the gas and the melt were equilibrated in a heated pressure vessel and the final pressure was measured. The amount of gas dissolved was determined by subtracting the number of moles of gas present in the gas phase, calculated from the Beattie - Bridgeman equation (2), from the number of moles originally admitted.

SOURCE AND PURITY OF MATERIALS:

Bone dry grade nitrogen, at least 99.98% pure from the National Cylinder Gas Co. was used.

Reagent grade sodium nitrate from Baker and Adamson was employed. To remove moisture, it was melted and allowed to freeze in a porcelain casserole contained in a dessicator.

ESTIMATED ERROR:

δP/atm = ± 3

REFERENCES:

1. Copeland, J. L.; Zybko, W. C. J. Phys. Chem. 1965, 69, 3631.

2. Beattie, J. A.; Bridgeman, O. C. J. Amer. Chem. Soc. 1928, 50, 3133.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Copeland, J. L.; Seibles, L.

J. Phys. Chem. 1966, 70, 1811 - 15.

VARIABLES:

T/K = 628 - 727

P/kPa = 14185.5 - 43164.5

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

	T = 669.5 K			T = 641.5 K	
415	16.0	6.64	387	19.8	7.67
332	17.7	5.87	314	19.1	5.99
258	18.0	4.64	244	20.2	4.94
205	18.3	3.75	194	19.3	3.74
151	20.4	3.08	144	20.1	2.90
	T = 655.5 K			T = 628.5 K	
398	19.5	7.77	375	21.0	7.89
323	18.3	5.91	306	19.9	6.07
251	18.7	4.71	238	20.0	4.76
200	18.8	3.77	192	17.9	3.43
148	18.6	2.75	140	20.1	2.82

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -(6.64 \pm 0.03) + (597 \pm 19)/(T/K)$$

The enthalpy of solution, ΔH, and standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kcal mol}^{-1} = -2.73 \pm 0.09$$

$$\Delta S°/\text{cal K}^{-1}\ \text{mol}^{-1} = -16.6 \pm 0.1$$

The errors indicated are the least-squares probable errors (authors).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: (1) Nitrogen; N_2; [7727-37-9] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	**ORIGINAL MEASUREMENTS:** Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075 - 77.
VARIABLES:	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

No depression in freezing point of the solvent was observed from the solubility of nitrogen at atmospheric pressure indicating that nitrogen solubility in sodium nitrate was less than 10^{-4} mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopy.

SOURCE AND PURITY OF MATERIALS:

Nitrogen from commercial cylinders (B.O.C.) was dried by passing through a liquid air trap.

Sodium nitrate containing less than 0.0003% of cation and less than 0.001% of anion impurities was dried for several days at 240°C followed by thermal shock technique (1). Drying was completed by evacuating the system after melting the salt.

ESTIMATED ERROR:

Freezing point was measured within ± 0.02°C.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R.

   Proc. Royal Soc. A 1959, 251, 156.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Kawamura, K; Teramato, Y.; Suzuki, Y.
Denki Kagaku 1982, 50, 232-235

VARIABLES:

T/K = 593 - 643
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Nitrogen gas solubilities, K_p(mol cm^{-3} atm^{-1}), at various temperatures are given below :

T/K	10^7K_p/mol cm^{-3} atm^{-1}
593	2.5 ± 0.20
643	3.4 ± 0.30

The enthalpy, ΔH, for dissolution of gas in the melt was calculated from the relation :

$$d \ln K_p/d(1/T) = -\Delta H/R$$

and was found to be :

$$\Delta H/\text{kcal mol}^{-1} = 4.7 \pm 2.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution Method.
Details of the apparatus, which was almost identical to that developed by Grimes et al. (1), are given in the paper. The melt in the saturating vessel was saturated with N_2 by bubbling the gas for 4h. The saturated melt was then transferred to the elution vessel and helium gas bubbled through it to liberate the dissolved N_2 from the melt. The amount of N_2 gas was determined quantitatively using gas chromatography.

SOURCE AND PURITY OF MATERIALS:

Reagent grade $NaNO_3$ was dried at 423K for a week.
Nominal purities of nitrogen and helium gases were 99.9989 % and 99.998 % respectively.

ESTIMATED ERROR:

Solubility = 6 - 10 % (authors)

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, **62**, 862.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Green, W. J. **Ph. D. Thesis**, Virginia Polytechnic Institute 1969.

Green, W. J.; Field, P. E.
J. **Phys. Chem.** 1980, **84**, 3111 - 3114.

VARIABLES:

T/K = 618 - 698
P/kPa = 50.663 - 151.988

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of N_2 in molten KNO_3 at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
618	2.93
623	2.71
624	2.77
632	2.39
643	2.58
672	3.05
685	3.16
686	3.21
698	2.90

Smoothed Data:
The temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.972 - 376.37/(T/K)$$

std. dev. = 1.1% (authors)

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kcal mol}^{-1} = 1.72 \pm 0.78$$

$$\Delta S/\text{cal K}^{-1}\text{ mol}^{-1} = -5.64 \pm 1.2 \quad \text{(at 668 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

Diagram and details of the gas solubility apparatus are given in the original publication.

After saturating the melt with nitrogen gas, the gas phase was evacuated. Helium was introduced into the system as eluting gas to approximately 1 atm. pressure. The resultant gas mixture of nitrogen and helium was analyzed with an Aerograph Model 90-P gas chromatograph (Varian).

SOURCE AND PURITY OF MATERIALS:

Dry nitrogen and helium obtained from Airco were used directly from the cylinders.

Reagent grade potassium nitrate from Baker was used without any further treatment.

ESTIMATED ERROR:

$\delta C/P = \pm 5\%$ (authors)

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Potassium nitrate; KNO_3;
[7757-79-1]

ORIGINAL MEASUREMENTS:

Frame, J. P.; Rhodes, E.;
Ubbelohde, A. R.

Trans. Faraday Soc. 1961, **57**, 1075 - 77.

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

No depression in freezing point of the solvent was observed from the solubility of nitrogen at atmospheric pressure. This indicated that nitrogen solubility in molten potassium nitrate was less than 10^{-4} mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopy.

SOURCE AND PURITY OF MATERIALS:

Nitrogen from commercial cylinders (B.O.C.) was dried by passing through a liquid air trap.

Potassium nitrate containing less than 0.0003% of cation and 0.001% of anion impurities was dried for several days at 240°C followed by the thermal shock technique (1). Drying was completed by evacuating the system after melting the salt.

ESTIMATED ERROR:

Freezing point was measured within ± 0.02°C

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R.

Proc. Royal Soc. A 1959, **251A**, 156.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Nitrogen; N_2; [7727-37-9] (2) Cesium nitrate; $CsNO_3$; [7789-18-6]	Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, **57**, 1075 - 77.
VARIABLES:	PREPARED BY:
	N. P. Bansal

EXPERIMENTAL VALUES:

No depression in freezing point of the solvent was observed from the solubility of nitrogen at atmospheric pressure. This indicated that nitrogen solubility in molten cesium nitrate was less than 10^{-4} mole fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopy.

SOURCE AND PURITY OF MATERIALS:

Nitrogen from commercial cylinders (B.O.C.) was dried by passing through a liquid air trap.

Cesium nitrate containing less than 0.1% of all impurities was dried at 240°C for many days followed by the thermal shock technique (1). Drying was completed by evacuating the system after melting the salt.

ESTIMATED ERROR:

Accuracy of freezing point measurement was ± 0.02°C

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R.
   Proc. Royal Soc. A 1959, **251A**, 156.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Zinc chloride; $ZnCl_2$; [7646-85-7]

ORIGINAL MEASUREMENTS:

Borodzinski, A.; Sokolowski, A.; Suski, L.

J. Chem. **Thermodyn.** 1975, 7, 655 - 60.

VARIABLES: P/kPa = 10 - 100
one temperatue : T/K = 720

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of nitrogen in the melt, the Henry's law constant, K_H, is:

T/K	Solubility/mol fraction Pa^{-1}	10^7 K_H/mol ml^{-1} atm^{-1}
720	$(3.33 \pm 0.10) \times 10^{-10}$	5.74[a]

[a] Value calculated by the compiler using density data of $ZnCl_2$ from Janz, G. J. **Molten Salts Handbook**, Academic Press, New York, 1967.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.
Schematic diagram of the experimental arrangement used is given in the original publication. The melt was saturated with nitrogen. The process of saturation was enhanced by a magnetic stirrer. The change in volume of the gas caused by its dissolution in the melt was determined. Temperature was controlled within ± 1 K.

SOURCE AND PURITY OF MATERIALS:

Nitrogen used was 99.99% pure.
Zinc chloride p. a. was distilled under vacuum prior to its distillation directly into the apparatus.

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1972, 68, 2083 - 89.

VARIABLES:

T/K = 508 - 603
P/kPa = 10^2

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solvent was an equimolar molten mixture of sodium and potassium nitrates. The solubilities of nitrogen in the melt at four temperatures are:

T/K	10^8 K_H/mol cm^{-3} bar^{-1}
508	0.73
533	0.88
573	1.1
603	1.4

Smoothed Data:

The temperature dependence of Henry's law constant, K_H, is expressed by:

$$\log(K_H/\text{mol cm}^{-3}\text{ bar}^{-1}) = -6.395 - 885.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.5% (compiler)

The enthalpy, ΔH, and standard entropy, $\Delta S°$, of solution are:

$$\Delta H/\text{kJ mol}^{-1} = 16.5$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -34 \quad \text{(at 533 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The details of the apparatus and procedure used for solubility measurements are described elsewhere (1). Briefly, the melt was vacuum degassed for a few hourrs. The vacuum was disconnected and nitrogen gas introduced at about one bar pressure. The melt was vigorously stirred and pressure changes were read from a manometer as a function of time until equilibrium was reached. The amount of gas dissolved was calculated from the final pressure variation after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

Nitrogen (High Purity grade) was purified by keeping in contact with Ascarite (A. H. Thomas Co) for several hours to remove CO_2 and other acidic impurities and molecular sieve 5A (Carlo Erba, Milano) at -80°C to remove water.

Reagent grade sodium and potassium nitrates were used to prepare the melt which was filtered in the molten state.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.

J. Electroanal. Chem. 1972, 38, 373.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]

(2) Sodium Nitrate; $NaNO_3$; [7631-99-4]

(3) Potassium Nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Kawamura, K; Teramato, Y.; Suzuki, Y.
Denki Kagaku <u>1982</u>, 50, 232-235

VARIABLES:

T/K = 543 - 643
KNO_3/mol % = 25 - 75
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Nitrogen gas solubilities, K_p(mol cm^{-3} atm^{-1}), at various temperatures are given below :

Melt composition /mole % KNO_3							
25		50		66		75	
T/K	10^7 K_p/mol cm^{-3} atm^{-1}	T/K	10^7 K_p/mol cm^{-3} atm^{-1}	T/K	10^7 K_p/mol cm^{-3} atm^{-1}	T/K	10^7 K_p/mol cm^{-3} atm^{-1}
593	2.0 ± 0.12	543	1.8 ± 0.12	593	1.5 ± 0.12	593	1.7 ± 0.10
643	2.6 ± 0.20	593	2.1 ± 0.12			643	2.0 ± 0.10
		643	2.4 ± 0.12				

The enthalpies, ΔH, for dissolution of gas in the melt were calculated from the relation :

$$d \ln K_p/d(1/T) = - \Delta H/R$$

The values of ΔH are given below :

Melt composition/mol % of KNO_3	ΔH/kcal mol^{-1}
25	4.0 ± 1.8
50	2.0 ± 0.6
75	2.5 ± 1.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution Method.
Details of the apparatus, which was almost identical to that developed by Grimes et al. (1), are given in the paper. The melt in the saturating vessel was saturated with N_2 by bubbling the gas for 4h. The saturated melt was then transferred to the elution vessel and helium gas bubbled through it to liberate the dissolved N_2 from the melt. The amount of N_2 gas was determined quantitatively using gas chromatography.

SOURCE AND PURITY OF MATERIALS:

Reagent grade $NaNO_3$ and KNO_3 were dried at 423K for a week.

Nominal purities of nitrogen and helium gases were 99.9989 % and 99.998 % respectively.

ESTIMATED ERROR:

Solubility = 6 - 10 % (authors)

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. <u>1958</u>, 62, 862.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]
(4) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

T/K = 973 - 1123
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of N_2 in the melt Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%) at different temperatures are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
700	0.69 ± 0.08
750	1.26 ± 0.07
800	1.34 ± 0.10
850	1.71 ± 0.11

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.367 - 2673.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 6.8% (compiler)

The heat of solution, ΔH, for the solubility of N_2 in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 51.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method.

The diagram and details of the apparatus used and procedure employed are described in the original publication. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS: (1) Fluorine; F_2; [7782-41-4] (2) Potassium chloride; KCl; [7447-40-7] (3) Cobalt chloride; $CoCl_2$; [7646-79-9]	**ORIGINAL MEASUREMENTS:** Klemm, W.; Huss, E. **Z. Anorg. Allg. Chem.** 1949, **258**, 221 - 25.
VARIABLES: one temperature: T/K = 598 P/kPa: 101.325 (compiler)	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of fluorine in the molten KCl - $CoCl_2$ (75 - 25 mol%) mixture at a single temperature is reported as:

t/°C	Solubility/mol(mol of melt)$^{-1}$
325	0.875

The high value of solubility is due to a chemical reaction between the melt and the fluorine resulting in the formation of K_3CoF_7.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Weight change, X-ray, chemical analysis.	**SOURCE AND PURITY OF MATERIALS:** Not available.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Fluorine; F_2; [7782-41-4]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Nickel chloride; $NiCl_2$; [7718-54-9]

ORIGINAL MEASUREMENTS:

Klemm, W.; Huss, E.

Z. Anorg. Allg. Chem. 1949, **258**, 221 - 25.

VARIABLES:

one temperature: T/K = 548
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of fluorine in the molten KCl - $NiCl_2$ (66 - 34 mol%) mixture at a single temperature is reported as:

t/°C	Solubilty/mol(mol of melt)$^{-1}$
275	1.0

The high solubility of fluorine in the melt is due to a chemical reaction between fluorine and the melt giving rise to the formation of K_2NiF_6.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Weight change, X-ray, chemical analysis.

SOURCE AND PURITY OF MATERIALS:

Not available.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Fluorine; F_2; [7782-41-4]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Cupric chloride; $CuCl_2$; [7447-39-4]

ORIGINAL MEASUREMENTS:

Klemm, W.; Huss, E.

Z. Anorg. Allg. Chem. 1949, 258, 221 -25.

VARIABLES:

one temperature T/K = 523
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of fluorine in molten KCl - $CuCl_2$ (75 - 25 mol %) mixture at a single temperature is reported as:

t/°C	Solubility/mol(mol of melt)$^{-1}$
250	0.75

The high value of solubility is due to a chemical reaction between fluorine and the melt giving rise to the formation of K_3CuF_6.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Weight change, X-ray, chemical analysis.

SOURCE AND PURITY OF MATERIALS:

Not available.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Chlorine; Cl_2; [7782-50-5] (2) Lithium chloride; LiCl; [7447-41-8]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Out of the three studies (1 - 3) available for the solubility of chlorine in molten lithium chloride, those by Wartenberg (1) and Tricklebank (2) are only of a preliminary nature. The results of Ryabukhin and Bukun (3) are not very reliable as the value of pressure, at which the gas solubilities have been measured, is not given.

Additional careful studies are needed before recommended solubilities can be advanced for this system.

References:

1. Wartenberg, H. V. **Zeitsch. Jur. Elektrochem.** 1926, 32, 330.

2. Tricklebank, S. B. **The Electrochem. Soc. Extended Abstracts** October 1969, Abstr. # 48.

3, Ryabukhin, Yu. M.; Bukun, N. G. **Russ. J. Inorg. Chem.** 1968, 13, 597.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Lithium Chloride; LiCl; [7447-41-8]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. Fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 893
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Cl_2 in molten LiCl at a single temperature has been reported as:

	solubility	
t/°C	weight fraction	volume fraction
620 ± 5	6.98×10^{-5}	32.7×10^{-3}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and procedure followed for gas solubility measurements are described in the original publication. Briefly, a quenched melt sample equilibrated with chlorine was analyzed for the chlorine content by reacting with KI solution and titrating with freshly standardized thiosulphate solution.

SOURCE AND PURITY OF MATERIALS:

Lithium chloride was pure and heated with NH_4Cl and NH_4Br to dehydrate.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Lithium Chloride; LiCl; [7447-41-8]

ORIGINAL MEASUREMENTS:

Tricklebank, S. B.

The Electrochem. Soc. Meeting Extended Abstracts, October 1969, Abstr. # 48.

VARIABLES:

one temperature: T/K = 923
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility, C_1, of chlorine in molten LiCl at one temperature is reported as:

t/°C	10^6 C_1/mol ml^{-1}
650	1.5 ± 0.5

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping technique.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Lithium chloride; LiCl; [7447-41-8]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.; Bukun, N. G.

Zh. Neorg. Khim. 1968, 13, 1141 - 45; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1968, 13, 597 - 600. (*).

VARIABLES:

T/K = 921 - 1145
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten LiCl at different temperatures are:

t/°C	$10^7\ C_1$/mol cm^{-3}
648	0.35
718	0.53
719	0.56
787	1.16
788	0.88
870	1.78
872	1.88

Smoothed Data:

The temperature dependence of the solubility of Cl_2 in molten LiCl is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -3.650 - 3548/(T/K) \quad \text{(compiler)}$$

std. dev. = 5.1% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 67.9 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The details of the apparatus and procedure used have been described elsewhere (1). In brief, the melt was saturated with chlorine. A part of the saturated melt was separated and sparged with argon to free the dissolved chlorine. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1966, 11, 1296.

COMPONENTS:	EVALUATOR:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Four experimental studies (1 - 4) are available for the solubility of chlorine in molten sodium chloride. One of these studies (1) is only of a preliminary nature. The results of reference (2) are not accurate because of the uncertainty in the temperature measurements and the reaction of dissolved gas with oxides on the stirrer or the walls of the vessel, according to Ryabukhin (3). The problem with the work of reference (3) is the value of the pressure, at which the gas solubilities have been measured, is not given. Tentative values based on the work of Andresen et al. (4) are given in Table 1.

Table 1

Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1090	4.18
1100	4.33
1110	4.48
1120	4.63
1130	4.79
1140	4.95
1150	5.11
1160	5.28
1170	5.44

References:

1. Wartenberg, H. U. **Zeitsch. Fur. Elektrochem.** 1926, **32**, 330.

2. Ryabukhin, Yu. M. **Russ. J. Inorg. Chem.** 1962, **7**, 565.

3. Ryabukhin, Yu. M.; Bukun, N. G. **Russ. J. Inorg. Chem.** 1968, **13**, 597.

4. Andresen, R. E.; Ostvald, T.; Oye, H. A. **Proc. Intl. Symp. Molten Salts (Pemsler, J. P. et al., eds.) The Electrochem. Soc.** 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. Fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 1093
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Cl_2 in molten NaCl at a single temperature has been reported as:

	solubility	
t/°C	weight fraction	volume fraction
820 ± 5	1.16×10^{-5}	5.63×10^{-3}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

For details of the apparatus and procedure, see the original paper. A quenched melt sample equilibrated with chlorine was analyzed for the chlorine content by reacting with KI solution and titrating with freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Sodium chloride used was pure and heated with NH_4Cl and NH_4Br to dehydrate.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5]	Ryabukhin, Yu. M.; Bukun, N. G. **Zh. Neorg. Khim.** 1968, 13, 1141 - 45; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1968, 13, 597 - 600. (*).
VARIABLES:	PREPARED BY:
T/K = 1113 - 1304 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten NaCl at different temperatures are:

t/°C	10^7 C_1/mol cm^{-3}
840	2.31
843	2.42
891	2.99
892	3.04
950	4.22
1030	5.87
1031	5.30

Smoothed Data:

The temperature dependence of the solubility of Cl_2 in molten NaCl is given by the equation:

$$\log(C_1/\text{mol cm}^{-3}) = -4.02 - 2905.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.9% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, changes for the solubility of Cl_2 are:

$\Delta H°/\text{kJ mol}^{-1} = 55.9 \pm 3.0$ $\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -76.7$ (at 1123 K

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Elution technique. The details of the apparatus and procedure used have been described elsewhere (1). In brief, the melt was saturated with chlorine. A portion of the saturated melt was separated and purged with argon to free the dissolved chlorine. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with thiosulfate solution.	Not described.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:
	1. Ryabukhin, Yu. M. **Russ. J. Inorg. Chem.** 1966, 11, 1296.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, 7, 1101 - 04; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1962, 7, 565 - 67. (*).

VARIABLES:

P/kPa = 98.925

T/K = 1120 - 1298

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten NaCl at different temperatures, under a pressure of 742 mm Hg are:

t/°C	10^7 C_1/mol cm^{-3}
847	2.21
881	3.02
935	4.65
973	5.80
1025	7.40

Smoothed Data:

Temperature dependence of the solubility of Cl_2 in molten NaCl is given by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -2.777 - 4325/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.3% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, changes for the solubility of Cl_2 are:

$$\Delta H°/\text{kJ mol}^{-1} = 82.7 \pm 4$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -53.2 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. In brief, the melt was saturated with chlorine by bubbling the gas through it. The dissolved chlorine was removed from the saturated melt by sparging it with argon. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Liquified chlorine (99.5%) was used.

Argon used contained 0.008% oxygen and 0.04% nitrogen.

Chlorine and argon were purified by bubbling through conc. H_2SO_4 and passing over P_2O_5.

Dried and remelted "chemically pure" grade NaCl was used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Andresen, R. E.; Ostvald, T.; Oye, H. A.
Proc. Int. Symp. Molten Salts (Pemsler, J. P., et al., eds.) The Electrochem. Soc. 1976, 111 - 22.

VARIABLES:

T/K = 1091 - 1170
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of chlorine in molten NaCl at different temperatures are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
818	4.12 ± 0.28
833	4.52
860	4.94 ± 0.39
897	5.39 ± 0.23

Smoothed Data:
The temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.699 - 1831.3/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.1% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, for the dissolution of chlorine are:

$$\Delta H°/\text{kJ mol}^{-1} = 36.5 \pm 4.7$$

$$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -88.8 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.
The diagram and details of the apparatus are given in the original paper and the method and procedure followed are described elsewhere (1). In brief, chlorine gas is filled into a thermostated volume above the melt which is kept in a closed quartz vessel. The drop in gas pressure is recorded as a function of time. The value of the pressure, at equilibrium, is used for determination of the gas solubility.

SOURCE AND PURITY OF MATERIALS:

Chlorine (99.5%) gas of "High Purity" from Matheson was used directly from the cylinder.
NaCl used was Baker Analysed and Merck suprapur. Before use the salt was melted and Cl_2 bubbled through the melt for about an hour and then recrystallized. Salts were handled in a glove box.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A.

   Proc. 4th Nordic High Temperature Symposium, Vol. 1, Helsinki 1975, 127.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A.
Proc. Fourth Nordic High Temp. Symp.-
NORTEMPS-75, 1975, 1, 127 - 142.

VARIABLES:

T/K = 1090 - 1168

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's Law constants, K_H, at various temperatures are given below

t/°C	10^7 K_H/mol $cm^{-3}atm^{-1}$
817	4.22
	4.63
	4.41
	4.12
	3.98
	3.97
860	5.05
	4.18
	5.28
	5.02
	5.18
895	5.30
	5.18
	5.20
	5.36

Heat of dissolution, ΔH, as evaluated from the expression:

$\Delta H = -R\ (\ln K_H)/\ d(1/T)$ was found to be 8.0 kcal mol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.
The method used for gas solubility measurements was the same as described earlier(1). The furnace temperature was controlled to better than ± 2°C.

SOURCE AND PURITY OF MATERIALS:

NaCl (Baker Analyzed) was melted and Cl_2 bubbled through it for 1h. The dissolved Cl_2 was removed by bubbling Ar for 10-15 min. The salt solidified, heated under dry N_2 to 20°C above its melting point, and then slowly recrystallized by lowering the temperature 4-5°C each hour. Clear salt crystals were picked up and used in the solubility experiment. Ar was 99.997%, from Norsk Hydro a. s.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Electroanal. Chem. 1972, 38, 373.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl;
[7647-14-5]

ORIGINAL MEASUREMENTS:

Ratvik, A. P.; Ostvald, T.; Oye, H. A.
Acta Chem. Scand. 1985, **A39**,
623 - 638.

VARIABLES:

T/K = 1100 - 1300
P/kPa = 10^2

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The validity of Henry's law was verified by measuring the solubility at various Cl_2 pressures. Temperature dependence of solubility, K_p (mol cm^{-3} bar^{-1}), is expressed by the relation :

$$\log K_p = (-4.263 \pm 0.214) - \frac{(2508.8 \pm 259.2)}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.
The procedure used for gas solubility measurements was similar to the one described elsewhere (1,2).
For details see the original publication.

SOURCE AND PURITY OF MATERIALS:

The quality and purification of salts have been described earlier(3).

ESTIMATED ERROR:

S. D. for log(solubility) = 0.027.

REFERENCES:

1.Waernes,O.; Ostvald,T.
Acta Chem. Scand. 1983, **A37**, 293.
2.Waernes,O.; Palmisano,F.; Ostvald,T
Acta Chem. Scand. 1983, **A37**, 207.
3.Andreson,R.E;Ostvald,T;Oye,H.A;**Proc. Int.Symp.Molten Salts. The Electrochem Soc.**, Princeton, NJ1976, 111

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Waernes, O.; Palmisano, F.; Ostvald, T.;
Acta Chem. Scand. 1983, **A37**, 207-217.

VARIABLES:

T/K = 1119 - 1210

P/kPa = 119.990 - 133.322

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's law constant, K_H, for the solubility of Cl_2 at various temperatures are given below

T/°C	10^7 K_H/mol $cm^{-3}atm^{-1}$
846	4.54 ± 0.19
892	5.87 ± 0.17
937	6.86 ± 0.50

Temperature dependence of K_H can be expressed as:

$$\log K_H = -3.973 - 2646/T$$

Standard enthalpy for the dissolution of Cl_2 was evaluated from the equation :

$$\Delta H° = -R \, d\ln K_H/d(1/T)$$

and was found to be (50.7 ± 8.5)kJ mol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The method used for gas solubility measurements was essentially the same as earlier described(1).

For details see the original paper.

SOURCE AND PURITY OF MATERIALS:

NaCl(p.a) from E. Merck AG was dried under vacuum at 400°C for 2h. The salt was recrystallized from the melt under N_2 atmosphere. Only clear crystals were used.

Ar(>99.99%) from Norsk Hydro a.s, Norway was used without further purification.

Cl_2 (>99.6%) from J. T. Baker Chemicals was used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. **Proc. Fourth Nordic High Temp. Symp.- NORTEMPS - 75**, 1975, 1, 127

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7447-40-7]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Out of the four studies (1 - 4) available for the solubility of chlorine in molten potassium chloride, the one by Wartenberg (1) is only of a preliminary nature. According to Ryabukhin (3), the results of their earlier work (2) are not accurate because of the uncertainty in the temperature measurements and the reaction of dissolved gas with oxides on the walls of the container or the stirrer. These problems have been overcome in their later investigation (3). However, in this study the value of the atmospheric pressure, at which the gas solubilities have been measured, is not reported.

Tentative solubility values based on the work of Andresen et al. (4) are given in Table 1.

Table 1

Tentative Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1070	(14.88)
1080	15.29
1090	15.71
1100	16.13
1110	16.56
1120	16.98
1130	17.42
1140	17.85
1150	18.29
1160	(18.73)

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

References:

1. Wartenberg, H. U. **Zeitsch. Fur. Elektrochem.** 1926, 32, 330.

2. Ryabukhin, Yu. M. **Russ. J. Inorg. Chem.** 1962, 7, 565.

3. Ryabukhin, Yu. M.; Bukun, N. G. **Russ. J. Inorg. Chem.** 1968, 13, 597.

4. Andresen, R. E.; Ostvald, T.; Oye, H. A. **Proc. Intl. Symp. Molten Salts (Pemsler, J. P., et al., eds.) The Electrochem. Soc.** 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. Fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 1093
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Cl_2 in molten KCl at a single temperature has been reported as:

	solubility	
t/°C	weight fraction	volume fraction
820 ± 5	5.03×10^{-5}	23.8×10^{-3}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Details of the apparatus and procedure followed for gas solubility measurements are given in the original paper. In brief, a quenched melt sample equilibrated with chlorine was analyzed for the chlorine content by reacting with KI solution and titrating with freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Potassium chloride used was pure and was dehydrated by heating with NH_4Cl and NH_4Br.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Andresen, R. E.; Ostvald, T.; Oye, H. A.
Proc. Int. Symp. Molten Salts (Pemsler, J. P., et al., eds.) The Electrochem. Soc. 1976, 111 - 22.

VARIABLES:

T/K = 1073 - 1158
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of chlorine in molten KCl at different temperatures are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
800	15.06 ± 0.35
839	16.49 ± 0.59
885	18.71 ± 0.22

Smoothed Data:
The temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.538 - 1379.8/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.5\% \quad \text{(compiler)}$$

The standard enthalpy, $\Delta H°$, and the standard entropy, $\Delta S°$, changes for the dissolution of chlorine are:

$$\Delta H°/\text{kJ mol}^{-1} = 26.3 \pm 2.2$$

$$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -87.0 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The diagram and details of the apparatus are given in the original publication and the method and procedure followed are described elsewhere (1). In brief, chlorine gas is filled into a thermostated volume above the melt which is kept in a closed quartz vessel. The drop in gas pressure is measured with time. The pressure reading, at equilibrium, is used for calculation of the gas solubility.

SOURCE AND PURITY OF MATERIALS:

Matheson "High Purity" chlorine (99.5%) was used directly from the cylinder.

Merck p.a. KCl was used. Before use, it was melted, Cl_2 bubbled through the melt for about an hour and then recrystallized. Salts were handled in a glove box.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A. **Proc. 4th Nordic High Temperature Symposium Vol. 1**, Helsinki, 1975, 127.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A.
Proc. Fourth Nordic High Temp. Symp.-
NORTEMPS - 75, 1975, 1, 127 - 142.

VARIABLES:

T/K = 1073 - 1158

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law constants, K_H, at various temperatures are given below:

T/°C	10^7 K_H/mol $cm^{-3}atm^{-1}$
800	14.96
	15.28
	14.87
	14.66
	15.54
840	16.38
	16.54
	17.18
	16.76
	15.57
885	18.65
	18.90
	18.87
	18.42

Heat of dissolution, ΔH, as evaluated from the expression :

$\Delta H = -R \ d\ln K_H / d(1/T)$ was found to be 7.5 kCal mol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.
The method used for gas solubility measurements was the same as described earlier(1). The furnace temperature was controlled to better than ± 2°C.

SOURCE AND PURITY OF MATERIALS:

KCl (Merck, P. A.) was melted and Cl_2 bubbled through it for 1h. The dissolved Cl_2 was removed by bubbling Ar for 10-15 min. The salt was solidified, heated under dry N_2 to 20°C above its melting point, and then slowly recrystallized by lowering the temperature 4-5°C each hour. Clear salt crystals were picked up and used in the solubility experiment. Ar was 99.997%, from Norsk Hydro a. s.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
   J. Electroanal. Chem. 1972, 38, 373.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.; Bukun, N. G.

Zh. Neorg. Khim. 1968, 13, 1141 - 45; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1968, 13, 597 - 600. (*).

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1096 - 1299

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten KCl at different temperatures are:

t/°C	$10^7\ C_1$/mol cm^{-3}
823	13.30
824	12.04
827	13.90
828	12.90
890	16.30
890	16.88
958	20.00
958	20.30
1025	25.14
1026	25.50

Smoothed Data:

The temperature dependence of the solubility of Cl_2 in molten KCl is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -4.025 - 2044.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.8% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, changes for the solubility of Cl_2 are:

$$\Delta H°/\text{kJ mol}^{-1} = 38.8 \pm 2$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -77.4 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The details of the apparatus and procedure employed have been described elsewhere (1). In brief, the melt was saturated with chlorine. A portion of the saturated melt was separated and purged with argon to remove dissolved chlorine. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1966, 11, 1296.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, 7, 1101 - 04; **Russ. J. Inorg. Chem.**(Eng. Transl.) 1962, 7, 565 - 67. (*)

VARIABLES:

$P/kPa = 98.925$

$T/K = 1121 - 1318$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten KCl at different temperatures, under a pressure of 742 mm Hg are:

t/°C	10^7 C_1/mol cm^{-3}
848	10.40
851	11.24
925	13.93
985	16.63
1038	20.32
1045	18.89

Smoothed Data:

Temperature dependence of the solubility of Cl_2 in molten KCl is given by the expression:

$$\log(C_1/\text{mol cm}^{-3}) = -4.204 - 1978.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.7% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, of solution are

$$\Delta H°/\text{kJ mol}^{-1} = 26.4 \pm 7$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -89.4 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. In brief, the melt was saturated with chlorine by bubbling the gas through it. The dissolved chlorine was removed from the saturated melt by flushing it with argon. The liberated chlorine was absorbed in KI solution and amount of iodine generated was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Liquified chlorine (99.5%) was used. Argon used contained 0.008% oxygen and 0.04% nitrogen. Chlorine and argon were purified by bubbling through conc. H_2SO_4 and passing over P_2O_5.

Dried and remelted "chemically pure" grade KCl was used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Potassium chloride; KCl; [7747-40-7]

ORIGINAL MEASUREMENTS:

Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronayaeva, O. N.
Sov. J. Non-Ferrous Met. 1970, 11, 49-52.

VARIABLES:

T/K = 1073 - 1173

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Cl_2, C(mol cm^{-3}), in molten KCl is expressed by the equation :

$$C = \frac{1.215 \times 10^{-2}}{T} \exp \left[\frac{-10780 - 5.28T}{RT} \right]$$

Where T is the temperature in kelvin, and R is the gas constant.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Desorption Method : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 mins. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution.

The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took 15 min. (approx.) to saturate the chloride melt with HCl and 15-20 mins. to expel the dissolved HCl by bubbling Ar gas.

SOURCE AND PURITY OF MATERIALS:

Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used.

Dried and remelted chemically-pure salts were used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Rubidium chloride; RbCl; [7791-11-9]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Two experimental studies (1,2) have been reported for the solubility of chlorine in molten rubidium chloride. However, in the work of Leonova and Ukshe (1), the chlorine gas pressure at which solubility measurements have been carried out is not given.

Tentative values based on the work of Andresen et al. (2) are given in Table 1.

Table 1

Tentative Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1020	18.94
1030	19.47
1040	20.02
1050	20.56
1060	21.11
1070	21.66

References:

1. Leonova, L. S.; Ukshe, E. A. Sov. Electrochem. 1970, 6, 871.

2. Andresen, R. E.; Ostvald, T.; Oye, H. A. Proc. Intl. Symp. Molten Salts (Pemsler, J. P., et al. eds.) The Electrochem. Soc. 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS:

Andresen, R. E.; Ostvald, T.; Oye, H. A.
Proc. Int. Symp. Molten Salts (Pemsler, J. P. et al., eds.) The Electrochem. Soc. 1976, 111 - 22.

VARIABLES:

T/K = 1016 - 1070
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of chlorine in molten RbCl at different temperatures are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
743	18.49 ± 0.89
771	20.76 ± 0.36
797	21.36 ± 0.48

Smoothed Data:
The temperature dependence of K_H is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.472 - 1275.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.4% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, changes for the dissolution of chlorine are:

$$\Delta H°/\text{kJ mol}^{-1} = 23.7 \pm 3.5$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -86.3 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.
The diagram and details of the apparatus are given in the original paper. The method and procedure followed are described elsewhere (1). In brief, chlorine gas is filled into a thermostated volume above the melt which is kept in a closed quartz vessel. The drop in gas pressure is measured with time. The pressure reading, at equilibrium, is used for calculation of gas solubility.

SOURCE AND PURITY OF MATERIALS:

Matheson "High Purity" chlorine (99.5%) was used directly from the cylinder.
Merck p.a. RbCl was used. Before use, it was melted, Cl_2 bubbled through the melt for about an hour and then recrystallized. Salts were handled in a glove box.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A. **Proc. 4th Nordic High Temperature Symposium, Vol. 1,** Helsinki 1975, 127.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS:

Leonova, L. S.; Ukshe, E. A.

Elektrokhim. 1970, 6, 892 - 3;
Sov. Electrochem. 1970, 6, 871.

VARIABLES:

T/K = 1054 - 1275
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten RbCl at different temperatures are:

t/°C	10^7 C_1/mol cm^{-3}
781	24.0
789	24.6
858	27.8
860	28.2
940	33.3
943	34.1
977	35.3
1002	36.6

Smoothed Data:
The temperature dependence of the solubility of Cl_2 in molten RbCl is given by the expression:

$$\log(C_1/\text{mol cm}^{-3}) = -4.537 - 1143.2/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.6\% \quad \text{(compiler)}$$

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 21.9 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.
The method followed for the determination of gas solubilities has been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1962, 7, 565.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Cesium chloride; CsCl; [7647-17-8]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Two studies (1 - 2) are available for the solubility of chlorine in molten cesium chloride. However, in the work of Ryabukhin and Bukun (1), the value of atmospheric pressure, at which the gas solubilities have been measured, is not given.

Tentative values based on the work of Andresen et al. (2) are given in Table 1.

Table 1

Tentative Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
940	34.32
960	34.86
980	35.39
1000	35.91
1020	36.41
1040	36.90
1060	37.38
1080	37.85
1100	38.31
1120	38.75
1140	39.19

References:

1. Ryabukhin, Yu. M.; Bukun, N. G. **Russ. J. Inorg. Chem.** 1968, 13, 597.

2. Andresen, R. E.; Ostvald, T.; Oye, H. A. **Proc. Intl. Symp. Molten Salts** (Pemsler, J. P., et al. eds.) The Electrochem. Soc. 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Cesium chloride; CsCl; [7647-17-8]

ORIGINAL MEASUREMENTS:

Andresen, R. E.; Ostvald, T.; Oye, H. A.
Proc. Int. Symp. Molten Salts (Pemsler, J. P. et al., eds.) The Electrochem. Soc. 1976, 111 - 22.

VARIABLES:

T/K = 935 - 1138
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of chlorine in molten CsCl at different temperatures are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
662	35.96 ± 1.63
711	33.21 ± 1.60
731	35.57 ± 0.60
798	38.30 ± 2.00
865	39.57 ± 2.22

Smoothed Data:
The temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.136 - 308.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.2% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, changes for the dissolution of chlorine are:

$$\Delta H°/\text{kJ mol}^{-1} = 11.1 \pm 1.9 \quad \text{(compiler)}$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -93.5 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.
The diagram and details of the apparatus are given in the original paper. The method and procedure followed are described elsewhere (1). In brief, chlorine gas is filled into a thermostated volume above the melt which is kept in a closed quartz vessel. The drop in gas pressure is measured with time. The pressure reading, at equilibrium, is used for calculation of gas solubility.

SOURCE AND PURITY OF MATERIALS:

Matheson "High Purity" chlorine (99.5%) was used directly from the cylinder.
Merck p.a. CsCl was used. Before use, it was melted, Cl_2 bubbled through the melt for about an hour and then recrystallized. Salts were handled in a glove box.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A. **Proc. 4th Nordic High Temperature Symposium, Vol. 1, Helsinki** 1975, 127.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Cesium chloride; CsCl;
[7647-17-8]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.; Bukun, N. G.

Zh. Neorg. Khim. 1968, **13**, 1141 - 45.
Russ. J. Inorg. Chem. (Eng. Transl.)
1968, 13, 597 - 600. (*).

VARIABLES:

T/K = 954 - 1195
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten CsCl at different temperatures are:

t/°C	10^7 C_1/mol cm^{-3}
661	34.8
678	34.6
721	36.6
721	35.3
760	37.9
778	38.2
849	42.1
851	41.1
851	43.6
919	45.9
922	44.8
922	47.6

Smoothed Data:

The temperature dependence of the solubility of Cl_2 in molten CsCl is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -4.877 - 557.2/(T/K) \quad \text{(compiler)}$$

standard dev = 0.9% (compiler)

std. dev. = 0.9% (compiler)

The standard enthalpy, ΔH°, and standard entropy, ΔS°, of solution are:

$$\Delta H°/\text{kJ mol}^{-1} = 11.9 \pm 1$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -92.9 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The details of the apparatus and procedure used have been described elsewhere (1). In brief, the melt was saturated with chlorine. A portion of the saturated melt was separated and purged with argon to remove the dissolved chlorine. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1966, **11**, 1296.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Cesium chloride; CsCl; [7647-17-8]	Ratvik, A. P.; Ostvald, T.; Oye, H. A. **Acta Chem. Scand.** 1985, **A39**, 623 - 638.
VARIABLES:	PREPARED BY:
T/K = 975 - 1175 P/kPa = 10^2	N. P. Bansal

EXPERIMENTAL VALUES:

The validity of Henry's law was verified by measuring the solubility at various Cl_2 pressures. Temperature dependence of solubility, K_p (mol cm^{-3} bar^{-1}), is given by the expression :

$$\log K_p = (-5.383 \pm 0.045) - \frac{(114.2 \pm 47.8)}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The procedure used for gas solubility measurements was similar to the one described elsewhere (1,2).

For deltails see the original publication.

SOURCE AND PURITY OF MATERIALS:

The quality and purification of salts have been described earlier(3)

ESTIMATED ERROR:

S. D. in log(solubility) = 0.007.

REFERENCES:

1.Waernes,O.; Ostvald,T.
Acta Chem. Scand. 1983, **A37**, 293.
2.Waernes,O.;Palmisano,F.; Ostvald,T
Acta Chem. Scand. 1983, **A37**, 207.
3.Andreson,R.E; Ostvald,T;Oye,H.A;Proc.
Int.Symp.Molten Salts. The Electrochem
Soc., Princeton, NJ,1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, **7**, 1101 - 04; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1962, **7**, 565 - 67. (*)

VARIABLES:

P/kPa = 98.925

T/K = 1058 - 1226

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten $MgCl_2$ at different temperatures, under a pressure of 742 mm Hg, are:

t/°C	$10^7\ C_1$/mol cm^{-3}
785	5.72
833	6.76
925	7.12
953	8.33

Smoothed Data:

Temperature dependence of the solubility of Cl_2 in molten $MgCl_2$ is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -5.248 - 1043.3/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 2.9\% \quad \text{(compiler)}$$

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, of solution are:

$$\Delta H°/\text{kJ mol}^{-1} = 19.9 \pm 5$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -100.5 \quad \text{(at 1123 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original publication. Briefly speaking, the melt was saturated with chlorine by bubbling the gas through it. The dissolved chlorine was freed from the saturated melt by flushing it with argon. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Liquefied chlorine (99.5%) was used. Argon used contained 0.008% oxygen and 0.04% nitrogen. The two gases were purified by bubbling through conc. H_2SO_4 and passing over P_2O_5.

Dried and remelted "chemically pure" grade $MgCl_2$ was used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Magnesium chloride; $MgCl_2$;
[7786-30-3]

ORIGINAL MEASUREMENTS:

Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronayaeva, O. N.
Sov. J. Non-Ferrous Met. 1970, 11, 49-52.

VARIABLES:

T/K = 1023 - 1173

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The temperature dependence of the solubility of Cl_2, C(mol cm^{-3}), in molten $MgCl_2$ is expressed by the equation:

$$C = \frac{1.215 \times 10_{-2}}{T} \exp\left[\frac{-3880 + 3.43T}{RT}\right]$$

Where T is the temperature in kelvin, and R is the gas constant.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Desorption Method : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 mins. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution.

The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took ≈ 15 min. to saturate the chloride melt with HCl and ≈15-20 mins. to expel the dissolved HCl by bubbling Ar gas.

SOURCE AND PURITY OF MATERIALS:

Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used.

Dried and remelted chemically - pure salts were used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Calcium chloride; $CaCl_2$; [10043-52-4]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. Fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 1073
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of chlorine in molten $CaCl_2$ at a single temperature has been reported as:

	solubility	
t/°C	weight fraction	volume fraction
800 ± 5	2.2×10^{-3}	6.96×10^{-3}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and procedure followed for gas solubility measurements are described in the original publication. Briefly, a quenched melt sample equilibrated with chlorine was analyzed for the chlorine content by reacting with KI solution and titrating with freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Calcium chloride used was pure and was dehydrated by heating with NH_4Cl and NH_4Br.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Lead chloride; $PbCl_2$; [7758-95-4]

ORIGINAL MEASUREMENTS:

Van Norman, J. D.; Tivers, R. J.

Molten Salts: Characterization and Analysis (Mamantov, G., ed.), Marcel Dekker, New York, 1969, 509 - 27.

VARIABLES:

T/K = 786 - 912

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in molten lead chloride at different temperatures, at one atmosphere pressure, are:

t/°C	10^7 C_1/mol cm^{-3}	10^6 X_1/mol fraction
513	0.52	2.95
535	0.64	3.62
585	0.78	4.45
630	1.04	6.12
639	1.10	6.47

Smoothed Data:

The temperature dependence of solubility is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -5.03 - 1765.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.8% (compiler)

The standard heat of solution, $\Delta H°$, for the dissolution of Cl_2 is:

$$\Delta H°/\text{kJ mol}^{-1} = 39.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original publication. In brief, the melt was saturated with chlorine by bubbling the gas through it. After saturation, the melt was sparged with argon to liberate the dissolved chlorine. The freed chlorine was absorbed in an aqueous KI solution and the iodine produced was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Reagent grade lead chloride was treated by passing HCl gas through the powder and temperature was slowly raised from room temperature to about 50°C above the melting point. Last traces of moisture were removed by bubbling HCl through the melt for about 2 hrs. The dissolved HCl gas was removed by argon flushing. Finally the melt was filtered through a quartz frit.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Silver chloride; AgCl; [7783-90-6]

ORIGINAL MEASUREMENTS:

Van Norman, J. D.; Tivers, R. J.

Molten Salts: Characterization and Analysis (Mamantov, G., ed.) Marcel Dekker, New York 1969, 509 - 27.

VARIABLES:

one temperature: T/K = 791

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of chlorine in molten AgCl at one atmosphere pressure is:

t/°C	solubility/mol cm^{-3}	solubility/mol fraction
518	2.31×10^{-7}	6.95×10^{-6}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original paper. In brief, chlorine was bubbled through the melt till it was saturated with the gas. After saturation, the melt was flushed with argon to liberate the chlorine in solution. The freed chlorine was absorbed in aqueous KI solution and the iodine produced was titrated against a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Reagent grade AgCl was treated by passing HCl gas through the salt powder and temperature was slowly raised from room temperature to about 50°C above the melting point. Last traces of moisture were removed by bubbling HCl through the melt for about 2 hrs. The dissolved HCl gas was removed by argon flushing. Finally the melt was filtered through a quartz frit.

ESTIMATED ERROR:

solubility: ± 10% (compiler)

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Chlorine; Cl_2; [7782-50-5] (2) Lithium chloride; LiCl; [7447-41-8] (3) Potassium chloride; KCl; [7447-40-7]	N. P. Bànsal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Four experimental studies are available for the solubility of chlorine in the molten eutectic LiCl - KCl. The results of Greenberg and Sundheim (1), and Olander and Camahort (2) are only of preliminary nature and are not worth consideration here any further. Smoothed data at different temperatures from the other two investigations are presented below for comparison:

	10^7 K_H/mol cm^{-3} atm^{-1}	
T/K	Nakajima et al. (3)	Van Norman & Tivers (4)
680	(1.24)	1.30
700	(1.36)	1.40
720	(1.48)	1.49
740	1.61	1.59
760	1.74	1.70
780	1.87	1.80
800	2.01	1.90
820	2.15	2.00
840	2.29	(2.11)
850	2.36	(2.16)

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

The results of Nakajima et al. (3), and of Van Norman and Tivers (4) are in very good agreement within experimental precision. The recommended solubility values for this gas - molten salt system, taken as the mean of these two data sets are presented in Table 1 and also in Fig. 1.

References:

1. Greenberg, J.; Sundheim, B. R. **J. Chem. Phys.** 1958, 29, 1029.
2. Olander, D. R.; Camahort, J. L. **A.I.Ch.E. Jour.** 1966, 12, 693.
3. Nakajima, T.; Imato, H.; Nakanishi, K.; Watanabe, N. **Denki Kagaku** 1974, 42, 85.
4. Van Norman, J. D.; Tivers, R. J. in "**Molten Salts: Characterization and Analysis (Mamantov, G., ed.)**" Marcel Dekker, New York, 1969, 509.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Lithium chloride; LiCl; [7447-41-8]

(3) Potassium chloride; KCl; [7447-40-7]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Table 1

Recommended Solubilities as a Function of Temperature

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
680	1.27
700	1.38
720	1.49
740	1.60
760	1.72
780	1.83
800	1.95
820	2.08
840	2.20
850	2.26

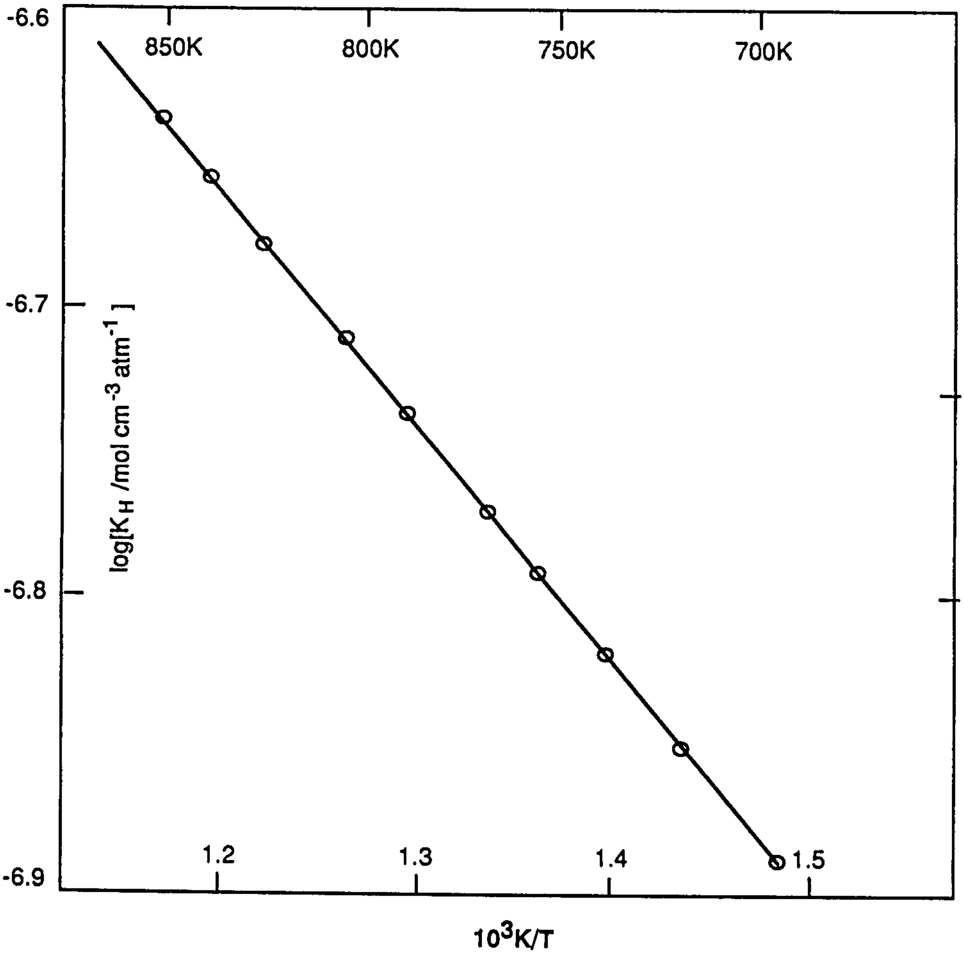


Fig. 1

COMPONENTS:	EVALUATOR:
(1) Chlorine; Cl_2; [7782-50-5] (2) Lithium chloride; LiCl; [7447-41-8] (3) Potassium chloride; KCl; [7447-40-7]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

EFFECT OF MELT COMPOSITION

Only Nakajima et al. (3) have studied the effect of solvent composition on the solubility of chlorine in molten LiCl - KCl. Their numerical values, which may be treated as tentative, at different melt compositions are given in Table 2. These are also presented in Fig. 2.

Table 2

Solubilities as a Function of Melt Composition

T/K	Melt Composition/mol% LiCl	10^7 K_H/mol cm^{-3} atm^{-1}
848	50	2.80 ± 0.10
848	59	2.32 ± 0.18
848	69	1.65 ± 0.19
848	78	1.10 ± 0.11

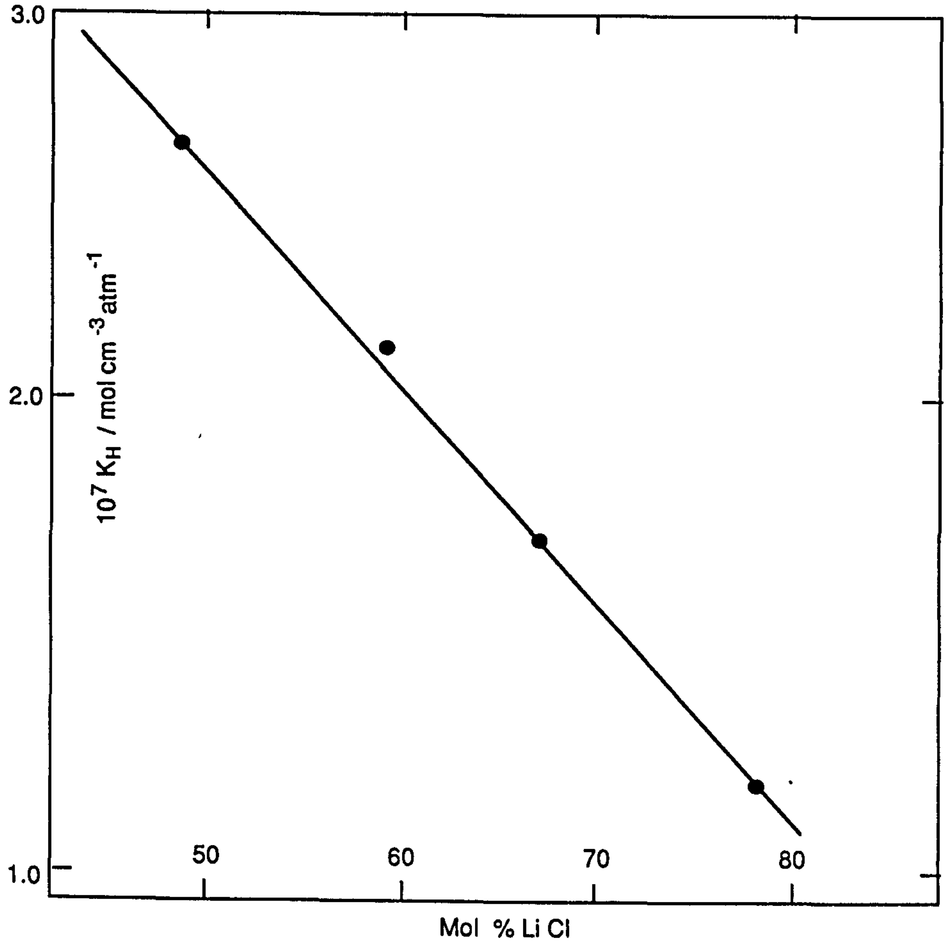


Fig. 2

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Nakajima, T.; Imoto, H.; Nakanishi, K.; Watanabe, N.

Denki Kagaku 1974, 42, 85 - 88.

VARIABLES:

T/K = 723 - 848
melt comp./mol% LiCl = 50 - 78
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in molten mixtures of LiCl - KCl of different compositions are:

melt comp./mol% LiCl	t/°C	10^7 C_1/mol ml^{-1}
50	575	2.80 ± 0.10
59	450	1.49 ± 0.02
	525	2.03 ± 0.08
	575	2.32 ± 0.18
69	575	1.65 ± 0.19
78	575	1.10 ± 0.11

Smoothed Data:
Temperature dependence of solubility in the molten eutectic LiCl - KCl (59 - 41 mol%) can be expressed by the relation:

$$\log(C_1/\text{mol ml}^{-1}) = -5.504 - 954.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.9% (compiler)

The heat of solution, ΔH, in the molten LiCl - KCl eutectic is:

$$\Delta H/\text{kJ mol}^{-1} = 18.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.
The diagram and details of the apparatus and the procedure are given in the original paper. Chlorine gas is passed through the melt till saturation is reached. A portion of the saturated melt is separated and flushed with argon to free the dissolved chlorine which is allowed to react with KI and the iodine liberated is titrated with a standard sodium thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Lithium and potassium chlorides were of reagent grade.
The Cl_2 gas had a purity better than 98%.
LiCl - KCl melt was prepared by dehydrating under an atmosphere of HCl using the method of Laitinen et al. (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Laitinen, H. A.; Ferguson, W. S.; Osteryoung, R. A.

J. Electrochem. Soc. 1957, 104, 516.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Van Norman, J. D.; Tivers, R. J.

Molten Salts: Characterization and Analysis (Mamantov, G., ed.), Marcel Dekker, New York 1969, 509 - 27.

VARIABLES:

T/K = 623 - 823
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in the molten LiCl - KCl eutectic at different temperatures, at one atmosphere pressure, are:

t/°C	10^7 C_1/mol cm^{-3}	10^6 x_1/mol fraction
400	1.26	4.19
450	1.54	5.21
500	1.70	5.83
550	2.05	7.14

Smoothed Data:

The temperature dependence of solubility is given by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -5.784 - 749.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.3% (compiler)

The standard heat of solution, $\Delta H°$, for the dissolution of Cl_2 is:

$$\Delta H°/\text{kJ mol}^{-1} = 15.5$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. In brief, the melt was saturated with chlorine by bubbling the gas through it. After saturation the melt was purged with argon to free the dissolved chlorine. The liberated chlorine was absorbed in an aqueous KI solution and the iodine generated was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

The molten LiCl - KCl eutectic was prepared following the method of Laitinen et al. (1).

ESTIMATED ERROR:

solubility: ± 10% (compiler)

REFERENCES:

1. Laitinen, H. A.; Ferguson, W. S.; Osteryoung, R. A.

   J. Electrochem. Soc. 1957, 104, 516.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Lithium chloride; LiCl; [7447-41-8] (3) Potassium chloride; KCl; [7447-40-7]	Olander, D. R.; Camahort, J. L. **A.I.Ch.E. Jour.** 1966, 12, 693 - 99.
VARIABLES:	PREPARED BY:
T/K = 673 & 773 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of chlorine in molten eutectic LiCl - KCl (59 - 41 mol%) was measured at 400 and 500°C at one atmosphere pressure of the gas. It was found to be less than 4 x 10^{-9} g-mol cm^{-3}, the limit of detectability of the technique employed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Elution or stripping method. The method used for solubility measurements was essentially the same as described by Blander et al. (1). Chlorine was bubbled through the melt for 1 - 4 hours. A known amount of the saturated melt was transferred into the stripping section and flushed with argon to remove the dissolved chlorine. The freed chlorine was absorbed in sodium hydroxide solution and analyzed.	Not described. ESTIMATED ERROR: REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Greenberg, J.; Sundheim, B. R.

J. Chem. Phys. 1958, 29, 1029 - 32.

VARIABLES:

one temperature: T/K = 673

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of chlorine in molten LiCl - KCl eutectic at the gas pressure of slightly less than one atmosphere is reported as:

t/°C	10^3 Solubility/molar
400	0.1 - 1

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High temperature spectroscopy. The technique for obtaining absorption spectra of molten salt solutions has been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Analytical grade LiCl - KCl were used without further purification except for careful drying.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sundheim, B. R.; Greenberg, J. Rev. Sci. Instr. 1956, 27, 703.

COMPONENTS:	EVALUATOR:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Three experimental studies (1 - 3) are available for the solubility of chlorine in molten equimolar NaCl - KCl. All these investigations are from the same group of workers. According to Ryabukhin the results reported in ref. (2) are better than those reported in his earlier work (1) because of some errors associated with the experimental procedure. However, in ref. (2) the value of the pressure, at which the gas solubilities have been measured, is not given. Also, the results are reported only in graphical form and the graph given is so small that accurate values of gas solubilities cannot be read at different temperatures. The reults of Leonova et al. (3) who have reported gas solubilities for four different melt compositions at different temperatures, may be treated as highly tentative, at least until additional studies become available for comparison. Smoothed data at different temperatures and melt compositions, based on (3), are given in Table 1.

Table 1
Solubilities as a Function of Temperature and Composition

	10^7 K_H/mol cm^{-3} atm^{-1}			
	Melt Composition/mol% NaCl			
T/K	12.5	25.0	50.0	75.0
1020	-	(7.44)	6.15	-
1050	-	8.25	6.82	4.01
1080	12.29	9.09	7.51	4.52
1110	13.34	9.97	8.24	5.06
1140	14.42	10.87	8.99	5.64
1170	15.53	11.81	9.77	6.25
1200	16.66	12.77	10.57	6.89
1230	17.82	13.76	11.39	7.56
1260	18.99	14.77	12.23	8.25
1290	20.18	15.81	13.10	8.98
1320	21.38	(16.87)	(13.97)	(9.73)

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

References:

1. Ryabukhin, Yu. M. **Russ. J. Inorg. Chem.** 1962, 7, 565.

2. Ryabukhin, Yu. M. **Russ. J. Inorg. Chem.** 1966, **11**, 1296.

3. Leonova, L. S.; Ryabukhin, Yu. M.; Ukshe, E. A. **Sov. Electrochem.** 1969, 5, 424.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	Leonova; L. S.; Ryabukhin, Yu. M.; Ukshe, E. A. **Elektrochem.** 1969, 5, 464 - 6; **Sov. Electrochem.** (Eng. Transl.) 1969, 5, 424 - 425. (*).

VARIABLES:	PREPARED BY:
T/K = 1011 - 1320 melt comp./mol% NaCl = 12.5 - 75 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in molten NaCl - KCl mixtures (12.5, 25, 50, 75 mol% NaCl), at different temperatures, at one atmosphere pressure, are:

Melt composition/mol% NaCl	t/°C	10^7 C_1/mol cm^{-3}
12.5	810	12.4
	814	12.5
	885	14.8
	960	18.25
	962	18.55
	1041	20.8
	1047	21.2
25.0	755	7.75
	798	8.17
	800	9.69
	878	10.86
	956	13.60
	959	13.70
	1033	16.80

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The technique employed for solubility measurements was the same as described earlier (1). The melt was saturated with chlorine by bubbling the gas at a gas pressure of 1 atm. A part of the saturated melt was transferred into the stripping section and the dissolved chlorine was displaced by flushing with argon. The liberated chlorine was absorbed in KI solution. The iodine generated was titrated against a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Not reported.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1966, **11**, 1296.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	Leonova, L. S.; Ryabukhin, Yu. M.; Ukshe, E. A. **Elektrokhim.** 1969, 5, 464 -6; **Sov. Electrochem.** (Eng. Transl.) 1969, 5, 424 - 25. (*).
VARIABLES:	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued

Melt composition/mol% NaCl	t/°C	10^7 C_1/mol cm^{-3}
50.0	738	6.10
	793	7.28
	843	8.30
	855	8.37
	948	11.22
	952	10.80
	1014	13.30
	1020	13.56
75.0	780	4.20
	853	5.12
	855	5.50
	935	6.95
	938	6.99
	1008	8.82
	1014	9.23

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	Leonova, L. S.; Ryabukhin, Yu. M.; Ukshe, E. A. **Elektrokhim.** 1969, 5, 464 - 6; **Sov. Electrochem.** (Eng. Transl.) 1969, 5, 424 - 25. (*).
VARIABLES:	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

Temperature dependence of solubility in the ranges studied obeyed the relation:

$$\log(C_1/\text{mol cm}^{-3}) = a + b/(T/K)$$

Values of the coefficients a and b, together with the enthalpies of solution, ΔH, in the four molten mixtures (evaluated by the compiler) are:

Melt composition/ mol% NaCl	a	b	ΔH/ kJ mol^{-1}	std. dev.
12.5	-4.586	-1430.5	27.4	0.8%
25.0	-4.564	-1595.8	30.6	2.4%
50.0	-4.641	-1601.8	30.7	1.3%
75.0	-4.512	-1979.1	37.9	1.5%

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, 7, 1101 - 04; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1962, 7, 565 - 67. (*).

VARIABLES:

P/kPa = 98.925

T/K = 1023 - 1301

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten NaCl - KCl (50 - 50 mol%) at different temperatures, under a pressure of 742 mm Hg, are:

t/°C	10^7 C_1/mol cm^{-3}
750	3.65
800	4.59
825	5.85
850	7.00
855	6.65
900	8.72
900	8.23
968	12.43
970	12.10
1028	14.10

Smoothed Data:

Temperature dependence of the solubility of Cl_2 in molten NaCl - KCl (50 - 50 mol%) is given by the expression:

$$\log(C_1/\text{mol cm}^{-3}) = -3.536 - 2971.7/(T/K) \quad \text{(compiler)}$$
$$\text{std. dev.} = 2.3\% \quad \text{(compiler)}$$

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 56.9 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original publication. In brief, the melt was saturated with chlorine by bubbling the gas through it. The chlorine dissolved was freed from the saturated melt by sparging it with argon. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Liquified chlorine (99.5%) was used. Argon contained 0.008% oxygen and 0.04% nitrogen. Chlorine and argon were purified by bubbling through conc. H_2SO_4 and passing over P_2O_5.

Dried and remelted "chemically pure" grade NaCl and KCl were used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1966, 11, 2415 - 16.
Russ. J. Inorg. Chem. (Engl. Transl.) 1966, 11, 1296 - 97. (*).

VARIABLES:

T/K = 1003 - 1273
P/kPa = 101.325 (1 atm)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in the molten mixture NaCl - KCl (50 - 50 mol%) at different temperatures are presented in graphical form. The graph given is too small to justify the interpolation of gas solubilities, with reasonable accuracy, at different temperatures.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. Briefly, the melt was saturated with chlorine by bubbling the gas through it at a gas pressure of 1 atm. A portion of the saturated melt was transferred into the stripping section. From this melt the dissolved chlorine was freed by purging it with argon. The liberated chlorine was absorbed in KI solution, and iodine generated was titrated with thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Chlorine was prepared by electrolysis of fused lead chloride. Argon contained 0.01% nitrogen, 0.003% oxygen, 0.004% water. Argon was purified by passing through columns of Anhydrone and phosphorus pentoxide.

NaCl and KCl were of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronayaeva, O. N. **Sov. J. Non-Ferrous Met. 1970**, 11, 49-52.
VARIABLES: T/K = 1024 - 1175 P/kPa: 101.325 (1 atm.)	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of Cl_2 in 55.6 NaCl - 44.4 KCl(wt%) melt at various temperatures are:

t/°C	10^7C/mol cm^{-3}
751	1.430
803	1.973
855	2.900
902	4.930

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Desorption Method : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 min. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution.

The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took ≈ 15 min. to saturate the chloride melt with HCl and ≈15-20 mins. to expel the dissolved HCl by bubling Ar gas.

SOURCE AND PURITY OF MATERIALS:

Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used.

Dried and remelted chemically - pure salts were used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Cesium chloride; CsCl; [7647-17-8]	Waernes, O.; Palmisano, F.; Ostvald, T.; **Acta Chem. Scand.** 1983, **A37**, 207-217.
VARIABLES: T/K = 1119 - 1210 Melt comp./ mol% NaCl = 35 P/kPa = 119.990 - 133.322	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's law constant, K_H, for the solubility of Cl_2 at various temperatures are given below

Melt comp/mol% NaCl	T/°C	10^7 K_H/mol $cm^{-3}atm^{-1}$
35	554	18.5 ± 0.7
	652	19.8 ± 0.2
	701	21.0 ± 0.3

Temperature dependence of K_H can be expressed as:

$$\log K_H = -5.384 - 290.4/T$$

Standard enthalpy for the dissolution of Cl_2 was evaluated from the equation :

$$\Delta H^\circ = -R \, d\ln K_H/d(1/T)$$

and was found to be (5.6 ± 1.3)kJ mol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The method used for gas solubility measurements was essentially the same as earlier described(1).

For details see the original paper.

SOURCE AND PURITY OF MATERIALS:

NaCl was dried under vacuum at 400°C for 2h. The salt was recrystallized from the melt under N_2 atmosphere. Only clear crystals were used. CsCl ("suprapur") was dehydrated with HCl HCl upto 400°C for 10h and melted under Cl_2. It was cooled to 50°C below the melting point and evacuated. Saturation with Cl_2 and evacuation were repeated three times and the salt recrystallized from the melt. HCl gas(>99.8%) and Ar(>99.9%) were used without further purification.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. **Proc. Fourth Nordic High Temp. Symp.- NORTEMPS - 75**, 1975, 1, 127.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, 7, 1101 - 04;
Russ. J. Inorg. Chem. (Eng. Transl.) 1962, 7, 565 - 67. (*).

VARIABLES:

P/kPa = 98.925
T/K = 842 - 1295

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten NaCl - $MgCl_2$ (50 - 50 mol%) at different temperatures, under a pressure of 742 mm Hg, are:

t/°C	10^7 C_1/mol cm^{-3}
569	0.48
659	1.31
731	1.77
820	2.12
913	3.37
1022	5.82

Smoothed Data:

Temperature dependence of the solubility of Cl_2 in molten NaCl - $MgCl_2$ (50 - 50 mol%) is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -4.426 - 2381.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 7.6% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 45.6 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. Briefly, the melt was saturated with chlorine by bubbling the gas through it. The dissolved chlorine was freed the saturated melt by sparging it with argon. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Liquified chlorine (99.5%) was used. Argon contained 0.008% oxygen and 0.04% nitrogen. The two gases were purified by bubbling through conc. H_2SO_4 and passing over P_2O_5.
Dried and remelted "chemically pure" grade NaCl and $MgCl_2$ were used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Chlorine; Cl_2; [7782-50-5] (2) Potassium chloride; KCl; [7447-40-7] (3) Magnesium chloride; $MgCl_2$; [7786-30-3]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Two studies (1,2) are available for the solubility of chlorine in molten equimolar KCl - $MgCl_2$ using the same (elution) technique. Smoothed data from these studies at different temperatures are presented below for comparison.

	10^7 K_H/mol cm^{-3} atm^{-1}	
T/K	Ryabukhin (1)	Lukmanova & Vil'nyanskii (2)[a]
800	1.90	2.69
850	2.42	3.03
900	3.01	3.35
950	3.65	3.67
1000	4.34	3.98
1050	5.08	4.27
1100	5.86	4.54
1150	6.67	4.80
1200	7.52	(5.04)
1250	8.40	(5.26)
1300	9.29	(5.47)

[a] Calculated by the evaluator using density data from G. J. Janz et al., **J. Phys. Chem. Ref. Data** 1975, **4**, 871.
Values in ( ) outside temperature interval of experimental measurements; extrapolated by the evaluator.

The two sets of data are not in agreement with each other. Values of Lukmanova et al. (2) are higher in the lower temperature range but lower at higher temperatures as compared to the results of Ryabukhin (1).

Further work is needed before recommended values can be advanced for this system.

References:

1. Ryabukhin, Yu. M. **Russ. J. Inorg. Chem.** 1962, **7**, 565.

2. Lukmanova, T. L.; Vil'nyanskii, Ya. E. **Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol.** 1966, **9**, 537.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, 7, 1101 - 04; **Russ. J. Inorg. Chem.** (Eng.Transl.) 1962, 7, 565 - 67. (*).

VARIABLES:

P/kPa = 98.925

T/K = 838 - 1320

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of chlorine in molten KCl - $MgCl_2$ (50 - 50 mol%) at different temperatures, under a pressure of 742 mm Hg, are:

t/°C	10^7 C_1/mol cm^{-3}	10^7 $K_H{}^a$/mol cm^{-3} atm^{-1}
565	2.18	2.23
585	2.42	2.48
586	2.62	2.68
685	3.07	3.14
685	3.90	3.99
767	4.22	4.32
779	5.84	5.98
844	6.94	7.11
866	5.62	5.76
927	7.13	7.30
983	8.06	8.26
1027	10.20	10.45
1047	8.70	8.91

[a] Calculated by the compiler assuming validity of Henry's law.

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. In brief, the melt was saturated with chlorine by bubbling the gas through it. The chlorine dissolved was freed from the saturated melt by flushing it with argon. The liberated chlorine was absorbed in KI solution and iodine generated was titrated with a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Liquefied chlorine (99.5%) was used. Argon contained 0.008% oxygen and 0.04% nitrogen. The two gases were purified by bubbling through conc. H_2SO_4 and passing over P_2O_5.

Dried and remelted "chemically pure" grade KCl and $MgCl_2$ were used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Ryabukhin, Yu. M.

Zh. Neorg. Khim. 1962, 7, 1101 - 04;
Russ. J. Inorg. Chem. (Eng. Transl.) 1962, 7, 565 - 67. (*)

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

Temperature dependence of the solubility of Cl_2 in molten equimolar KCl - $MgCl_2$ is expressed by the equation:

$$\log(C_1/\text{mol cm}^{-3}) = -4.940 - 1432.9/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 4.5\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 27.4 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vil'nyanskii, Ya. E.

Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1966, 9, 537 - 540.

VARIABLES:

T/K = 773 - 1173
P/kPa = 36.447 - 102.338

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of Cl_2 in molten equimolar KCl - $MgCl_2$ at different temperatures as a function of Cl_2 partial pressure are reported as:

		Solubility of Cl_2	
t/°C	P_{Cl_2}/atm	10^6 x_1/mol fraction	10^5 C_1/wt%
500	0.42	5.3	45
	0.65	8.1	68
	0.78	9.9	84
	1.01	12.2	102
650	0.39	7.1	60
	0.61	11.7	98
	0.80	14.9	125
	1.00	18.2	150
750	0.36	10.7	93
	0.63	15.6	129
	0.75	18.4	154
	1.01	22.3	190

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method. The apparatus and the method used for gas solubility measurements have been described earlier (1). Dry Cl_2 gas was passed through about 150 g of the melt at a rate of 10 l/hr. After saturation, a portion of the melt was transferred into the desorber and flushed with nitrogen. The chlorine gas liberated was determined iodometrically.

SOURCE AND PURITY OF MATERIALS:

The method of preparation of the anhydrous melt from carnellite has been described earlier (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Lukmanova, T. L.; Vil'nyanskii, Ya. E.

   Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1964, 7, 510.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vil'nyanskii, Ya. E.

Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1966, 9, 537 - 540.

VARIABLES:

T/K = 773 - 1173
P/kPa = 36.447 - 102.338

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

		Solubility of Cl_2	
t/°C	P_{Cl_2}/atm	$10^6\ x_1$/mol fraction	$10^5\ C_1$/wt%
850	0.38	15.4	127
	0.61	18.6	155
	0.79	22.0	183
	0.99	25.3	220
900	0.39	16.4	137
	0.62	20.7	177
	0.79	24.2	203
	1.00	27.1	230

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Cadmium chloride; $CdCl_2$; [10108-64-2]

ORIGINAL MEASUREMENTS:

Nakajima, T.; Imoto, H.; Nakanishi, K.; Watanabe, N.

Denki Kagaku 1974, 42, 85 - 88.

VARIABLES:

T/K = 753 - 848
melt comp./mol% KCl = 33 - 63
P/kPa = 101.325 (1 atm)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in molten mixtures of KCl - $CdCl_2$ of different compositions are:

melt comp./mol% KCl	t/°C	10^7 C_1/mol ml^{-1}
33	575	2.67 ± 0.32
50	575	4.21 ± 0.34
63	575	5.69 ± 0.26
	530	5.57 ± 0.18
	480	5.08 ± 0.08

Smoothed Data:

Temperature dependence of solubility in the molten mixture KCl - $CdCl_2$ (63 - 37 mol%) can be expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -5.843 - 336.4/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.0% (compiler)

The heat of solution, ΔH, in the melt KCl - $CdCl_2$ (63 - 37 mol%) is:

$$\Delta H/\text{kJ mol}^{-1} = 6.28$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus and the procedure are given in the original publication. Chlorine gas is passed through the melt till saturated. A portion of the saturated melt is separated and flushed with argon. The chlorine gas liberated is reacted with KI and the iodine generated is titrated against a standard sodium thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Potassium and cadmium chlorides were of reagent grade.

The chlorine gas had a purity better than 98%.

The KCl - $CdCl_2$ mixture was gradually heated under vacuum. Argon gas was blown in near the melting point. Dehydration was achieved by using Cl_2 and HCl.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Lead chloride; $PbCl_2$; [7758-95-4]

ORIGINAL MEASUREMENTS:

Kowalski, M.; Harrington, G. W.

Inorg. Nucl. Chem. Lett. 1967, 3, 121 - 24.

VARIABLES:

$T/K = 716 - 975$
melt comp./N_{KCl} = 0.23 - 0.70
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of chlorine in the molten mixtures of KCl - $PbCl_2$ of different compositions at various temperatures are:

melt composition/N_{KCl}	t/°C	$10^6\ C_1$/mol cm^{-3} atm^{-1}
0.23	454	1.41
	566	3.44
	635	5.40
0.48	443	1.84
	574	1.70
	692	1.59
0.60	513	1.90
	581	1.58
	671	1.32
0.70	588	1.77
	648	1.52
	702	1.40

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

A known volume of the melt at the desired temperature was saturated with chlorine by bubbling the gas through the melt. The dissolved chlorine is liberated by flushing the saturated melt with nitrogen. The freed chlorine is absorbed in aqueous KI solution and the iodine generated is determined by titration against a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Lead chloride; $PbCl_2$; [7758-95-4]

ORIGINAL MEASUREMENTS:

Kowalski, M.; Harrington, G. W.

Inorg. Nucl. Chem. Lett. 1967, 3, 121 - 24.

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

The temperature dependence of solubility is expressed by an equation of the type:

$$\log(C_1/\text{mol cm}^{-3}\ \text{atm}^{-1}) = a + b/(T/K)$$

The values of the coefficients a and b, alongwith the heats of solution, ΔH, for the dissolution of Cl_2 in molten KCl - $PbCl_2$ mixtures of different compositions are:

Melt composition/ N_{KCl}	a^*	b^*	ΔH^a/ kJ mol^{-1}	std. dev.*
0.23	-2.929	2125.4	33.2	0.26%
0.48	-5.978	174.7	- 4.16	0.3%
0.60	-6.667	742.5	-14.1	0.4%
0.70	-6.631	755.2	-15.4	0.8%

[a] Based on about 20 measurements over temperature range studied.

[*] Estimated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Aluminum chloride; $AlCl_3$; [7446-70-0]

ORIGINAL MEASUREMENTS:

Carpio, R. A.; King, L. A.; Ratvik, A. P.; Ostvold, T.; Oye, H. A
Light Metals 1981; Bell, G. M., ed.; American Institute of Mining, Metallurgical and Petroleum Engineers Inc., New York, 1981.

VARIABLES:

T/K = 430 - 545
melt comp./mol% NaCl = 40.1 & 50.4
P/kPa = 60.795 - 131.723

PREPARED BY:

N. P.Bansal

EXPERIMENTAL VALUES:

Solutions of chlorine in molten NaCl - $AlCl_3$ obeyed Henry's law. The values of Henry's law constant, K_H, at different temperatures in NaCl - $AlCl_3$ melts of two different compositions are:

Melt Composition/ mol% NaCl	T/K	$K_H \times 10^6$/ mol cm^{-3} atm^{-1}
40.1	432	12.59
	454	10.76
50.4	434	9.39
	452	8.13
	472	6.84
	495	6.0 ± 0.2
	518	5.31
	544	4.3 ± 0.1

Data in this table are derived, from the graph given in the original paper, by the compiler.

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The method used for chlorine solubility measurements was essentially the same as described elsewhere (1,2). The diagram of the apparatus is given in the original paper. Briefly, chlorine gas is filled into a thermostated volume above the melt. The drop in gas pressure, due to its solubility in the melt, is recorded as a function of time till a stable equilibrium pressure is reached. The gas solubility is calculated from the equilibrium gas pressure.

SOURCE AND PURITY OF MATERIALS:

Chlorine gas (ultra high purity) supplied by Matheson was used without further purification.

NaCl, Merck, p.a., was evacuated while the temperature was slowly raised to above the melting point. The salt was crystallized from the melt and only clear crystals were used for the experiments.

continued

ESTIMATED ERROR:

solubility: ± 4% (authors)

REFERENCES:

1. Zambonin, P. G.; Cardetta, V. L.; Signorile, G.

J. Electroanal. Chem. 1970, 28, 237.

continued

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Aluminum chloride; $AlCl_3$; [7446-70-0]

ORIGINAL MEASUREMENTS:

Carpio, R. A.; King, L. A.; Ratvik, A. P.; Ostvald, T.; Oye, H. A.
Light Metals 1981; Bell, G. M., ed.; American Institute of Mining, Metallurgical and Petroleum Engineers, Inc., New York, 1981.

VARIABLES:

T/K = 430 - 545
melt comp./mol% NaCl = 40.1 & 50.4

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

The temperature dependence of K_H in the melt containing 50.4 mol% NaCl can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -6.649 + 704/(T/K) \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = -13.6$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

continued

$AlCl_3$ (Fluka) was distilled twice and filtered through a quartz frit, leaving 10% behind each time. Some samples of $AlCl_3$ were purified by enclosing in a pyrex tube alongwith a very small amount of NaCl and high purity Al wire bits. The salt was melted and the ampoule slowly pulled out of the furnace. The impurities were left in the NaCl phase. This procedure was repeated.

ESTIMATED ERROR:

REFERENCES:

continued

2. Andresen, R. E.; Ostvald, T.; Oye, H. A. **Proc. of the Int. Symp. on Molten Salts, Pemsler, J. P., et al., eds., The Electrochem. Soc.,** Princeton, NJ 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]

(2) Sodium chloride; NaCl; [7647-14-5]
(3) Aluminum chloride; $AlCl_3$ [7446-70-0]

ORIGINAL MEASUREMENTS:

Ratvik, A. P.; Ostvald, T.; Oye, H. A.
Acta Chem. Scand. 1985, **A39**, 623 - 638.

VARIABLES:

$T/K = 450 - 1300$
Melt comp./mol% $AlCl_3$ = 0 - 60
$P/kPa = 10^2$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The validity of Henry's law was verified by measuring the solubility at various Cl_2 pressures. Temperature dependence of solubility, K_p (mol cm^{-3} bar^{-1}), can be expressed by the relation:

$$\log K_p = A + B/T$$

Values of the coefficients A and B for Cl_2 solubility in NaCl - $AlCl_3$ melts of various compositions are given below :

Melt composition (mol % $AlCl_3$)	Temp. range (K)	A	B
0	1100 - 1300	-4.263 ± 0.214	-2508.8 ± 259.2
5	1075 - 1275	-3.647 ± 0.204	-2927.3 ± 238.7
10	1100 - 1200	-3.803 ± 0.561	-2535.5 ± 643.9
20	1000 - 1300	-3.915 ± 0.123	-2120.9 ± 139.3
30	1000 - 1225	-4.563 ± 0.108	-1185.0 ± 119.4
40	950 - 1150	-4.724 ± 0.087	- 845.0 ± 89.2
50	625 - 825	-5.754 ± 0.028	- 271.5 ± 19.7
60	450 - 575	-5.012 ± 0.044	- 542.7 ± 22.2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.
The procedure used for gas solubility measurements was similar to the one described elsewhere(1,2). For details see the original publication.

SOURCE AND PURITY OF MATERIALS:

The quality and purification of salts have been described earlier(3).

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Waernes, O.; Ostvald, T.
Acta Chem. Scand. 1983, **A37**, 293.
2. Waernes, O.; Palmisano, F; Ostvald T; **Acta Chem. Scand.** 1983, **A37**, 207
3. Andresen, R. E.; Ostvald, T.; Oye, H. A; **Proc. Int. Symp. Molten salts** The Electrochem Soc. NJ. 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Cesium chloride; CsCl; [7647-17-8]
(3) Aluminium chloride; $AlCl_3$; [7446-70-0]

ORIGINAL MEASUREMENTS:

Waernes, O.; Ostvald, T.
Acta Chem. Scand. 1983, **A37**, 293-306.

VARIABLES:

$T/K = 633 - 1000$
melt comp/mol% $AlCl_3$ = 42.5 - 52.0
$P/kPa = 26.664 - 119.990$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's law constant, K_H, at various temperatures in CsCl-$AlCl_3$ melts of three different compositions are given below:

Melt comp/mol% $AlCl_3$	T/°C	10^7 K_H/mol $cm^{-3}atm^{-1}$
42.5	390^a	5.53 ± 0.03
43.5	360^a	5.59 ± 0.29
52	377	5.22 ± 0.12
	427	4.75
	477	4.21
	527	4.21
	627	3.73 ± 0.01
	727	3.60

[a] Saturated with CsCl. Melt composition is given as the intercept between the liquidus line and the actual melt temperature.

Linear regression analysis of the experimental data gives the following expression

$$\log K_H = -5.824 + 360.1/T$$

with a relative standard deviation of 5% in K_H.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The method used for gas solubility measurements was essentially the same as described earlier(1).

Due to high vapor pressure of chloroaluminate melts, Cl_2 gas dissolved in these melts was removed by reducing the Cl_2 pressure to 300 Torr, allowing the melt to remain at this pressure for equilibration.

SOURCE AND PURITY OF MATERIALS:

CsCl was purified as described earlier(1). $AlCl_3$ was distilled under vacuum just above the melting point. The procedure was repeated three times. Mixtures of $AlCl_3$+CsCl were prepared by melting and filtering of purified $AlCl_3$ and CsCl under vacuum. After remelting the filtrate was properly mixed and quenched. Purified salts were handled in a glove box under N_2 with water level < 2ppm.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Waernes, O.; Palmisano, F.; Ostvald, T.
Acta Chem. Scand. 1983, **A37**, 207.

COMPONENTS:

(1) Chlorine; [7782-50-5]

(2) Cesium chloride; CsCl; [7647-17-8]

(3) Aluminum chloride; $AlCl_3$ [7446-70-0]

ORIGINAL MEASUREMENTS:

Ratvik, A. P.; Ostvald, T.; Oye, H. A.
Acta Chem. Scand. 1985, **A39**, 623 - 638.

VARIABLES:

T/K = 650 - 1175
Melt comp./mol% $AlCl_3$ = 0 - 52
P/kPa = 10^2

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The validity of Henry's law was verified by measuring the solubility at various Cl_2 pressures. Temperature dependence of solubility, K_p (mol cm^{-3} bar^{-1}), can be expressed by the relation:

$$\log K_p = A + B/T$$

Values of the coefficients A and B for Cl_2 solubility in CsCl - $AlCl_3$ melts of various compositions are given below :

Melt composition (mol% $AlCl_3$)	Temp. range (K)	A	B
0	975 - 1175	-5.383 ± 0.045	-114.2 ± 47.8
5	925 - 1125	-5.707 ± 0.032	252.0 ± 31.8
10	925 - 1200	-5.559 ± 0.022	123.5 ± 23.3
20	900 - 1200	-5.627 ± 0.020	220.8 ± 20.5
30	875 - 1100	-5.717 ± 0.022	315.5 ± 21.4
30	850 - 1025	-5.689 ± 0.046	293.6 ± 42.6
40	750 - 1075	-5.658 ± 0.023	257.2 ± 21.1
49	650 - 950	-5.669 ± 0.015	267.7 ± 11.5
52	650 - 875	-5.661 ± 0.062	263.3 ± 46.6

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.
The procedure used for gas solubility measurements was similar to the one described elsewhere(1,2). For details see the original publication.

SOURCE AND PURITY OF MATERIALS:

The quality and purification of salts have been described earlier(3).

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Waernes, O.; Ostvald, T. **Acta Chem. Scand.** 1983, **A37**, 293.
2. Waernes, O.; Palmisano, F; Ostvald T. **Acta Chem. Scand.** 1983, **A37**, 207
3. Andresen, R. E.; Ostvald, T.; Oye, H. A; **Proc. Int. Symp. Molten salts** The Electrochem Soc. NJ. 1976, 111.

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Silver chloride; AgCl; [7783-90-6]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Sternberg, S.; Petrescu, V.

Rev. Roum. Chim. 1975, 20, 1231 - 41.

VARIABLES:

T/K = 673 - 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities, C_1, of chlorine in molten AgCl - KCl at different temperature are:

t/°C	10^7 C_1/mol cm^{-3}
400	8.24
500	12.9
600	23.9
700	24.7

The gas pressure under which the solubility measurements are made is not reported. The solubility values may be taken to be approximate only.

Smoothed Data:
Temperature dependence of C_1 is expressed by the equation:

$$\log(C_1/\text{mol cm}^{-3}) = -4.402 - 1129.3/(T/K) \quad \text{(compiler)}$$

std. dev. = 6.4%

The heat of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = +15.65$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chronopotentiometric method.

SOURCE AND PURITY OF MATERIALS:

Not reported.

ESTIMATED ERROR:

The solubility values are only approximate.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]
(4) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronyaeva, O. N.
Sov. J. Non-Ferrous Met. 1970, 11, 49-52.

VARIABLES:

T/K = 988 - 1180
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Cl_2, C in NaCl - KCl - $MgCl_2$ melts of various compositions at different temperatures are:

Melt comp/ wt%	t/°C	10^7C/mol cm^{-3}	Melt comp/ wt%	t/°C	10^7C/mol cm^{-3}
5.55 NaCl -	750	3.31	39 NaCl -	715	0.595
4.45 KCl -	807	3.84	31 KCl -	751	1.06
80 $MgCl_2$	845	3.93	30 $MgCl_2$	800	2.30
	903	3.92		870	3.69
				904	4.18
16.6 NaCl -	744	1.06			
13.4 KCl -	800	1.58	47.2 NaCl -	730	1.38
70 $MgCl_2$	851	1.37	37.8 KCl -	770	1.71
	905	1.69	5 $MgCl_2$	830	2.44
				850	3.08
27.7 NaCl -	715	0.566		905	3.50
23.3 KCl -	743	0.763			
50 $MgCl_2$	861	2.73	53 NaCl -	752	1.27
	902	3.39	42 KCl -	797	1.84
			5 $MgCl_2$	853	2.48
				907	3.00

cont.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Desorption Method : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 mins. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution.

The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took ≈ 15 min. to saturate the chloride melt with HCl and ≈15-20 mins. to expel the dissolved HCl by bubbling Ar gas.

SOURCE AND PURITY OF MATERIALS:

Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used.

Dried and remelted chemically - pure salts were used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Chlorine; Cl_2; [7782-50-5] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7] (4) Magnesium chloride; $MgCl_2$; [7786-30-3]	Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronayaeva, O. N. **Sov. J. Non-Ferrous Met. 1970**, 11, 49-52.
VARIABLES: T/K = 988 - 1180 P/kPa: 101.325 (1 atm.)	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued...

Temperature dependence of the solubility of Cl_2 in NaCl - KCl - $MgCl_2$ melts of two compositions is given by the equations:

$$C(\text{mol cm}^{-3}) = \frac{1.215 \times 10^{-2}}{T} \exp\left[\frac{-40660 - 30.3T}{RT}\right]$$

in 15 NaCl - 75 KCl - 10$MgCl_2$ (wt%) in the temperature range 700 - 940°C and

$$C(\text{mol cm}^{-3}) = \frac{1.215 \times 10^{-2}}{T} \exp\left[\frac{-24150 - 14.4T}{RT}\right]$$

in 50 NaCl - 40 KCl - 10 $MgCl_2$ (wt%) in the temperature region

730 - 870°C. T is the temperature in kelvin and R is the gas constant.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
<u>Desorption Method</u> : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 mins. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution. The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took ≈ 15 min. to saturate the chloride melt with HCl and ≈15-20 mins. to expel the dissolved HCl by bubbling Ar gas.	Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used. Dried and remelted chemically - pure salts were used. ESTIMATED ERROR: Not specified. REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; $NaCl$; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]
(4) Magnesium chloride; $MgCl_2$; [7786-30-3]
(5) Calcium chloride; $CaCl_2$; [10043-52-4]

ORIGINAL MEASUREMENTS:

Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronyaeva, O. N.
Sov. J. Non-Ferrous Met. 1970, <u>11</u>, 49-52.

VARIABLES:

$T/K = 993 - 1213$
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Temperature dependence of the solubility of Cl_2, C(mol cm^{-3}), in 50 NaCl - 5KCl - 10MgCl$_2$ - 35CaCl$_2$(wt%) melt is given by the expression:

$$C(\text{mol cm}^{-3}) = \frac{1.215 \times 10^{-2}}{T} \exp\left[\frac{-34580 - 22.55T}{RT}\right]$$

where T is the temperature in kelvin and R is the gas constant.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

<u>Desorption Method</u> : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 mins. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution.

The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took ≈ 15 min. to saturate the chloride melt with HCl and ≈15-20 mins. to expel the dissolved HCl by bubbling Ar gas.

SOURCE AND PURITY OF MATERIALS:

Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used.

Dried and remelted chemically - pure salts were used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Chlorine; Cl_2; [7782-50-5]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]
(4) Magnesium chloride; $MgCl_2$; [7786-30-3]
(5) Barium chloride; $BaCl_2$; [10361-37-2]

ORIGINAL MEASUREMENTS:

Muzhzhavlev, K. D; Lebedev, O. A; Tatakin, A. N; Dronyaeva, O. N.
Sov. J. Non-Ferrous Met. 1970, 11, 49-52.

VARIABLES:

T/K = 993 - 1093

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Temperature dependence of the solubility of Cl_2, C(mol cm^{-3}), in 50 NaCl - 10KCl - 10$MgCl_2$ - 30$BaCl_2$ (wt%) melt is given by the relation:

$$C\ (\text{mol cm}^{-3}) = \frac{1.215 \times 10^{-2}}{T} \exp\left[\frac{-39620 - 28.53T}{RT}\right]$$

where T is the temperature in kelvin and R is the gas constant.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Desorption Method : The melt was saturated with Cl_2 by bubbling the gas for about 1.5h at the rate of 6 - 10 liters/h. The melt was allowed to stand for 5 min. The melt was stripped of the dissolved Cl_2 by bubbling argon gas for about 20 mins. at a rate of 12 liters/h and the liberated gas was absorbed in a KI solution.

The salt was melted under a continuous flow of dry hydrogen chloride gas. The melt was purified with HCl gas for 0.5h followed by Ar gas for 0.5h. It took ≈ 15 min. to saturate the chloride melt with HCl and ≈15-20 mins. to expel the dissolved HCl by bubbling Ar gas.

SOURCE AND PURITY OF MATERIALS:

Liquified Cl_2 (≈99.5%) and argon meeting the GOST standard 10157-62 were used.

Dried and remelted chemically - pure salts were used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Bromine; Br_2; [7726-95-6] (2) Lithium bromide; LiBr; [7550-35-8]	Van Norman, J. D.; Tivers, R. J. **Molten Salts: Characterization and Analysis (Mamantov, G., ed.)** Marcel Dekker, New York 1969, 509 - 27.
VARIABLES:	**PREPARED BY:**
T/K = 890 & 981 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of bromine in molten lithium bromide at two at two temperatures, at one atmosphere pressure, are:

t/°C	10^7 C_1/mol cm^{-3}	10^6 x_1/mol fraction
617	17.5	61.0
709	10.4	37.2

Smoothed Data:

The temperature dependence of solubility is expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}) = -8.17 + 2148/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.08% (compiler)

The standard heat of solution, $\Delta H°$, for the dissolution of bromine is:

$$\Delta H°/\text{kJ mol}^{-1} = -39.7$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original paper. In brief, the melt was saturated with bromine by bubbling the gas through it. After saturation, the melt was purged with argon to free the dissolved bromine. The liberated bromine was passed through an aqueous KI solution and the iodine produced was titrated against a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Lithium bromide was treated by passing HBr gas through the salt powder while the temperature was raised from room temperature about 50°C above the melting point. Last traces of moisture were removed by bubbling HBr through the melt for about about 2h. The dissolved HBr was removed by argon flushing. The melt was finally filtered through a quartz frit.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Bromine; Br_2; [7726-95-6]

(2) Sodium bromide; NaBr; [7647-15-6]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 1073
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Br_2 in molten NaBr at a single temperature has been reported as:

t/°C	10^5 Solubility/wt. fraction
800	26.9

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and procedure followed for gas solubility measurements are described in the original paper. Briefly, a quenched melt sample equilibrated with bromine was analyzed for the bromine content by reacting with KI solution and titration against a freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Sodium bromide was pure and was dehydrated by heating with NH_4Cl and NH_4Br.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Bromine; Br_2; [7726-95-6]

(2) Potassium bromide; KBr; [7758-02-3]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

P/kPa: 101.325 (compiler)

one temperature: T/K = 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Br_2 in molten KBr at a single temperature has been reported as:

t/°C	10^5 Solubility/wt. fraction
800 ± 5	98.2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and the procedure followed for gas solubility measurements are described in the original paper. Briefly, a quenched melt sample equilibrated with bromine was analyzed for bromine content by reacting with KI solution and titration against a freshly standardized thiosulphate solution.

SOURCE AND PURITY OF MATERIALS:

Potassium bromide was pure and was dehydrated by heating with NH_4Cl and NH_4Br.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Bromine; Br_2; [7726-95-6]

(2) Calcium bromide; $CaBr_2$; [7789-41-5]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 1073

P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of Br_2 in molten $CaBr_2$ at a single temperature has been reported as:

t/°C	10^5 Solubility/wt. fraction
800 ± 5	18.4

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and the procedure followed for gas solubility measurements are given in the original paper. In brief, a quenched melt sample equilibrated with bromine was analyzed for the bromine content by reacting with KI solution and titration against a freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Calcium bromide was pure and was dehydrated by heating with NH_4Cl and NH_4Br.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Bromine; Br_2; [7726-95-6]

(2) Silver bromide; AgBr; [7785-23-1]

ORIGINAL MEASUREMENTS:

Block-Bolten, A.; Flengas, S. N.

Canad. J. Chem. 1971, 49, 2266 - 74.

VARIABLES:

T/K = 760 - 950

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of bromine in molten AgBr at different temperatures, at one atmosphere pressure of bromine, are:

T/K	10^4 C_1/mol cm^{-3}	10^3 x_1/mol fraction
760	1.076	3.66
790	0.985	3.38
810	0.865	2.97
860	0.645	2.24
862	0.639[a]	2.22[a]
885	0.543	1.89
897	0.491[a]	1.71[a]
950	0.414[a]	1.46[a]

[a] Values by spring balance; other values by torsion balance.

Smoothed Data:

The temperature dependence of solubility are given by the equations:

$$\log(C_1/\mathrm{mol\ cm^{-3}}) = -6.32 + 1830/(T/K) \quad \text{(compiler)}$$
$$\log(x_1/\mathrm{mol\ fraction}) = -4.72 + 1776/(T/K) \quad \text{(compiler)}$$
$$\text{std. dev.} = 1.5\% \quad \text{(compiler)}$$
$$\Delta H_{soln}(\mathrm{KJ\ mol^{-1}}) = -\ 34.60 \pm 2.51;$$
$$\Delta S_{soln}(\mathrm{JK^{-1}mol^{-1}}) = -\ 40.2 \quad \text{(at 860K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gravimetric method.

A quartz spring thermobalance, and the Ruska - Worden torsion quartz - fiber type microbalance were used. For further details about the experimental arrangement and the procedure followed for solubility measurements, refer to the original paper.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Bromine; Br_2; [7726- 95-6]

(2) Lead bromide; $PbBr_2$; [10031-22-8]

ORIGINAL MEASUREMENTS:

Van Norman, J. D.; Tivers, R. J.

Molten Salts: Characterization and Analysis (Mamantov, G., ed.) Marcel Dekker, New York 1969, 509 - 27.

VARIABLES:

T/K = 703 - 792

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of bromine in molten lead bromide at two temperatures, at one atmosphere pressure, are:

t/°C	10^7 C_1/mol cm^{-3}	10^6 x_1/mol fraction
430	13.9	92.1
519	12.3	83.2

Smoothed Data:

The temperature dependence of solubility is expressed by the equation:

$$\log(C_1/\text{mol cm}^{-3}) = -6.33 + 332/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.05% (compiler)

The standard heat of solution, $\Delta H°$, for the dissolution of bromine is:

$$\Delta H°/\text{kJ mol}^{-1} = -5.4$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original paper. In brief, the melt was saturated with bromine by bubbling the gas through it. After saturation, the melt was purged with argon to free the dissolved bromine. The liberated bromine was absorbed in an aqueous KI solution and the iodine produced was titrated against a standard thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Lead bromide was treated by passing HBr gas through the salt powder while the temperature was slowly raised from room temperature to about 50°C above the melting point. Last traces of moisture were removed by bubbling HBr through the melt for about 2 hrs. The dissolved HBr was removed by argon flushing. Finally, the melt was filtered through a quartz frit.

ESTIMATED ERROR:

solubility: ± 15% (compiler)

REFERENCES:

COMPONENTS: (1) Bromine; Br_2; [7726-95-6] (2) Lithium bromide; LiBr; [7550-35-8] (3) Potassium bromide; KBr; [7758-02-3]	ORIGINAL MEASUREMENTS: Greenberg, J.; Sundheim, B. R. **J. Chem. Phys.** 1958, 29, 1029 - 32.
VARIABLES: one temperature: T/K = 673	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Solubility, C, of bromine in molten LiBr - KBr eutectic at the gas pressure of slightly less than one atmosphere is reported as:

t/°C	Solubility/molar
400	10^{-3} - 10^{-4}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High temperature spectroscopy.

The technique for obtaining absorption spectra of molten salt solutions has been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Analytical grade LiBr and KBr were used without further purification except for careful drying.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Sundheim, B. R.; Greenberg, J.
Rev. Sci. Instr. 1956, 27, 703.

COMPONENTS:

(1) Iodine; I_2; [7553-56-2]

(2) Sodium iodide; NaI; [7681-82-5]

ORIGINAL MEASUREMENTS:

Wartenberg, H. U.

Zeitsch. fur. Elektrochem. 1926, 32, 330 - 36.

VARIABLES:

one temperature: T/K = 973
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of iodine in molten NaI at a single temperature has been reported as:

t/°C	10^3 Solubility/wt. fraction
700 ± 5	2.87[a]

[a] approximate value only

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and procedure followed for gas solubility measurements are given in the original paper. In brief, a quenched melt sample equilibrated with iodine was analyzed for the iodine content by titration against a freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Sodium iodide was pure and was dehydrated by heating with NH_4Cl and NH_4Br

ESTIMATED ERROR:

The solubility value is only approximate. (author)

REFERENCES:

COMPONENTS: (1) Iodine; I_2; [7553-56-2] (2) Potassium iodide; KI; [7681-11-0]	**ORIGINAL MEASUREMENTS:** Wartenberg, H. U. **Zeitsch. fur. Elektrochem.** 1926, 32, 330 - 36.
VARIABLES: one temperature: T/K = 973 P/kPa: 101.325 (compiler)	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of iodine in molten KI at a single temperature has been reported as:

t/°C	10^3 Solubility/wt. fraction
700 ± 5	6.29[a]

[a] approximate value only

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the apparatus used and procedure employed for gas solubility measurements are given in the original papaer. In brief, a quenched melt sample equilibrated with iodine was analyzed for the iodine content by titration against a freshly standardized thiosulfate solution.

SOURCE AND PURITY OF MATERIALS:

Potassium iodide was pure and was dehydrated by heating with NH_4Cl and NH_4Br.

ESTIMATED ERROR:

The solubility value is only approximate. (author)

REFERENCES:

COMPONENTS:

(1) Iodine; I_2; [7553-56-2]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Sacchetto, G. A.; Bombi, G. G.; Fiorani, M.

J. Electroanal. Chem. 1969, 20, 89 - 98.

VARIABLES:

T/K = 415 - 512
P/kPa = 1.814 - 37.490

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities, C_1, of iodine in the molten $LiNO_3$ - KNO_3 (43 - 57 mol%) mixture, in the temperature interval 415 - 512 K, are presented in the form of a log C_1 vs. 1/T plot. Solubility of iodine at 450 K is given as:

T/K	$C_1 \times 10^3$/mol kg^{-1} atm^{-1}
450	1.46 ± 0.13

Smoothed Data:

Temperature dependence of C_1 is expressed by the relation:

$$\log C_1 = -2.836 + 962(1/T - 1/450) \quad (T = 415 - 512 \text{ K})$$

The enthalpy of solution, ΔH, and the entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = -18.41 \pm 5.02$$

$$\Delta S/\text{J K}^{-1} \text{ mol}^{-1} = -94.98 \pm 10.88$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A mixture of iodine and nitrogen at a known partial pressure of iodine was passed through the melt. A part of the molten solution was quenched and dissolved in aqueous KI solution and its absorbance at 350 nm was measured with a Zeiss PMQ II spectrophotometer.

SOURCE AND PURITY OF MATERIALS:

Iodine from C. Erba, Milan, was used without further purification.

Reagent grade lithium and potassium nitrates from C. Erba, Milan were used. The procedure employed for preparing the molten salt solvent has been described elsewhere (1).

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Mazzocchin, G. A.; Bombi, G. G.; Fiorani, M.

J. Electroanal. Chem. 1968, 17, 95.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Iodine; I_2; [7553-56-2] (2) Lithium chloride; LiCl; [7447-41-8] (3) Potassium chloride; KCl; [7447-40-7]	Greenberg, J.; Sundheim, B. R. **J. Chem. Phys.** 1958, **29**, 1029 - 32.
VARIABLES:	PREPARED BY:
one temperature: T/K = 673 P/kPa: 101.325 (compiler)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of iodine in molten LiCl - KCl eutectic at a single temperature is reported as:

t/°C	Solubility/molar
400	10^{-3} - 10^{-4}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High temperature spectroscopy.

The technique for obtaining absorption spectra of molten salt solutions has been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Analytical grade LiCl and KCl were used without further purification except for careful drying.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Sundheim, B. R.; Greenberg, J. **Rev. Sci. Instr.** 1956, **27**, 703.

COMPONENTS:

(1) Iodine; I_2; [7553-56-2]
(2) Lithium iodide; LiI; [10377-51-2]
(3) Potassium iodide; KI; [7681-11-0]

ORIGINAL MEASUREMENTS:

Greenberg, J.; Sundheim, B. R.

J. Chem. Phys. 1958, 29, 1029 - 32.

VARIABLES:

one temperature: T/K = 673
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of iodine in molten LiI - KI eutectic at one temperature is reported as:

t/°C	Solubility/molar
400	10^{-3} - 10^{-4}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High temperature spectroscopy.

The technique for obtaining absorption spectra of molten salt solutions has been described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Analytical grade LiI and KI were used without further purification except for careful drying.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Sundheim, B. R.; Greenberg, J. Rev. Sci. Instr. 1956, 27, 703.

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]

(2) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 1023 - 1223

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol cm^{-3} atm^{-1}), in the melt at various temperature are given below, where K_p is the Henry's law constant.

T/K	10^7 K_p/mol cm^{-3} atm^{-1}
1023	4.59 ± 0.52
1073	4.31 ± 0.36
1123	3.65 ± 0.29
1173	3.48 ± 0.32
1223	3.24 ± 0.27

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -7.356 + \frac{1043}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $MgCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt.

Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K.

CO gas was produced through decomposition of formic acid.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO;[630-08-0]

(2) Calcium chloride; $CaCl_2$; [10043-52-4]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES: P/kPa: 101.325 (compiler)

T/K = 1073 - 1123

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol $cm^{-3}atm^{-1}$), in the melt at various temperatures are given below, where K_p is the Henry's law constant.

T/K	10^7 Kp/mol cm^{-3} atm^{-1}
1073	1.02 ± 0.12
1093	0.98 ± 0.09
1113	0.94 ± 0.10
1123	0.93 ± 0.07

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -7.940 + \frac{1012}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $CaCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt.

Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K.

CO gas was produced through decomposition of formic acid.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO;[630-08-0]

(2) Strontium chloride; $SrCl_2$; [10476-85-4]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.;
Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES:

P/kPa: 101.325 (compiler)

T/K = 1173 - 1323

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol cm^{-3} atm^{-1}), in the melt at various temperatures are given below, where K_p is the Henry's law constant.

T/K	10^7 K_p/mol cm^{-3} atm^{-1}
1173	1.25 ± 0.13
1213	1.01 ± 0.14
1253	0.99 ± 0.09
1293	0.98 ± 0.11
1323	0.97 ± 0.12

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -7.816 + \frac{1041}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 -5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $SrCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt.

Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K.

CO gas was produced through decomposition of formic acid.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]

(2) Barium chloride; $BaCl_2$; [10361-37-2]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 1253 - 1373

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol $cm^{-3}atm^{-1}$), in the melt at various temperatures are given below, where K_p is the Henry's law constant.

T/K	10^7 K_p/mol cm^{-3} atm^{-1}
1253	0.75 ± 0.12
1293	0.98 ± 0.12
1333	1.02 ± 0.17
1373	1.37 ± 0.23

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -4.599 - \frac{3154}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $BaCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt.

Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K.

CO gas was produced through decomposition of formic acid.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO;
[630-08-0]

(2) Lithium carbonate; Li_2CO_3;
[554-13-2]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 1073 & 1123

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO in the molten Li_2CO_3 at two temperatures are:

t/°C	$10^4\ C_1{}^a$/mol dm^{-3} atm^{-1}
800	0.59 ± 0.09
850	2.25 ± 0.36

[a] The solubility of CO in molten Li_2CO_3 appears to be entirely chemical

Smoothed Data:

The heat of solution, ΔH, for the solubility of CO in the melt is:

$$\Delta H/\mathrm{kJ\ mol^{-1}} = \approx 250.$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and the procedure followed are described in the original paper. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hrs. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all of the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A moleculat sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were made.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS: (1) Carbon monoxide; CO; [630-08-0] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	ORIGINAL MEASUREMENTS: Allulli, S. J. Phys. Chem. 1969, 73, 1084 - 87.
VARIABLES: one temperature: T/K = 433	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of carbon monoxide in the molten eutectic $LiNO_3$ - KNO_3 at 433K was found to be too small ($<10^{-7}$ mol fraction torr^{-1}) to be measured with the experimental technique used.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

SOURCE AND PURITY OF MATERIALS:

CO from Gerling Halz & Co., Hamburg, was used without further purification. Its purity, checked by mass spectrometry, was better than 99.5%.

$LiNO_3$ (ERBA RP) was dehydrated at 70°C to avoid hydrolysis. KNO_3 (ERBA RP) was finely powdered and dried under vacuum at 110°C for 24 hr.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon monoxide; CO; [630-08-0] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, **69**, 2014 - 18.
VARIABLES:	**PREPARED BY:**
T/K = 508 - 573 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solvent was an equimolar molten mixture of sodium nitrate - potassium nitrate. The solubilities of carbon monoxide in the melt at various temperatures are:

T/K	10^7 K_H/mol cm^{-3} bar^{-1}
508	0.123
533	0.152
573	0.204

Smoothed Data:

The temperature dependence of Henry's law constant, K_H, is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{bar}^{-1}) = -5.98 - 980/(T/K)$$

std. dev. = 0.12% (compiler)

The heat of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kJ mol}^{-1} = 18$$

$$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -26 \quad \text{(at 533 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

High sensitivity pressure measuring technique.

The diagram and details of the apparatus are described elsewhere (1). The melt was evacuated at 10^{-5} bar for several hours for degassing. The vacuum was disconnected and carbon monoxide was introduced at one atm. The melt was vigorously stirred with a magnetic stirrer. The pressure variations were noted, with a high precision differential manometer, as a function of time until the equilibrium pressure was reached. The amount of gas dissolved was calculated from the rapid initial pressure changes after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

Carbon monoxide (High Purity grade) was further purified by keeping it in contact with Ascarite (A. H. Thomas Co., Philadelphia) to remove carbon dioxide and with molecular sieve 5A (Carlo Erba, Milano) at -80°C to remove moisture. The final water content was <10 ppm.

The sodium and potassium nitrates were of reagent grade(Carlo Erba, Milano). The solvent was purified and filtered in the molten state.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.

J. Electroanal. Chem. 1972, **38**, 373.

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Zezyanov, S. P.; Ll'ichev, V. A.

Zh. Neorg. Khim. 1972, 17, 2541 - 42; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1972, 17, 1329 - 30. (*).

VARIABLES:

P/kPa = 10.133 - 101.325

T/K = 963 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, C_1, of CO in molten NaCl - KCl (50 - 50 mol%) at different temperatures are:

t/°C	10^7 C_1/mol cm^{-3}
690	2.78
705	2.95
755	3.42
800	3.86
805	3.92
875	4.74
895	4.98
900	5.07

Gas pressure at which solubilities are measured, not given.

Smoothed Data:

Variation of the solubility with temperature is expressed by the equation:

$$\log(C_1/\text{mol cm}^{-3}) = -5.116 - 1388.3/(T/K) \quad \text{(compiler)}$$

std. dev. 0.34% (compiler)

The heat of solution, ΔH, has been estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 26.6 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The diagram and details of the apparatus used and procedure followed are given in the original paper. In brief, the melt was saturated with CO by bubbling the gas through it. A part of the saturated melt was transferred into the desorber and purged with argon to liberate the dissolved CO. The carbon monoxide was oxidized to carbon dioxide by passing the mixture of CO and argon from the desorber over copper (II) oxide heated to 673 - 773 K. The carbon dioxide was absorbed in 0.005N barium hydroxide solution. The excess of hydroxide was back titrated with hydrochloric acid and thymol phthalein.

SOURCE AND PURITY OF MATERIALS:

Carbon monoxide was prepared by the decomposition of formic acid in concentrated sulfuric acid. It was further purified and dried. Argon used was to specification GOST10157-62.

"Chemically Pure" grade NaCl and KCl were used.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L., Vil'nyanskii, Ya. E.
Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Teknol. 1966, 9, 537 - 540.

VARIABLES:

$T/K = 773 - 1123$
$P_{CO}/atm = 0.2 - 1.0$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of carbon monoxide in molten equimolar KCl - $MgCl_2$ at 500, 650, 750 and 850°C are presented in the form of a figure, as a function of pressure. It is not possible to read precise values of solubility from the figure which is too small.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The apparatus and the method used for gas solubility measurements have been described earlier (1). Dry CO gas was passed through about 170 g of the melt at a rate of 10 l/hr. After saturation, a portion of the melt was transferred into the desorber and flushed with nitrogen. The liberated CO was determined by oxidation with I_2O_5

SOURCE AND PURITY OF MATERIALS:

The method for preparation of the anhydrous melt from carnallite has been described elsewhere (1).

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Lukmanova, T. L.; Vil'nyanskii, Ya. E. **Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Teknol.** 1964, 7, 510.

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc.. 1980, 127, 1655 - 59.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 1023 - 1123

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO in the melt Li_2CO_3 - Na_2CO_3 (53.3 - 46.7 mol%) at different temperatures are:

t/°C	10^4 $C_1{}^a$/mol cm^{-3} atm^{-1}
750	3.04 ± 0.24
800	3.68 ± 0.20
850	5.61 ± 0.20

[a] Physical solubility of CO in the melt

Smoothed Data:

The temperature dependence of C_1 can be expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}\text{ atm}^{-1}) = -3.564 - 3039.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 4.6% (compiler)

The heat of solution, ΔH, for the solubility of CO in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 58.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method.

The diagram and details of the apparatus used and procedure followed are described in the original publication. In brief, the melt was saturated by bubbling the gas for 2 - 3 hrs. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all of the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent samples were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 1023 - 1123

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO in the melt Li_2CO_3 - K_2CO_3 (42.7 - 57.3 mol%) at three temperatures are:

t/°C	10^4 $C_1{}^a$/mol dm^{-3} atm^{-1}
750	3.25 ± 0.22
800	4.54 ± 0.39
850	5.36 ± 0.22

[a] Physical solubility of CO in the melt.

Smoothed Data:

Temperature dependence of C_1 can be expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.025 - 2510.4/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 2.6\% \quad \text{(compiler)}$$

The heat of solution, ΔH, for the solubility of CO in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 48.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and the procedure followed have been described in the original paper. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hrs. After saturation, a portion of the melt was transferred into the quenching compartment where it was slowly chilled to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 -10 independent measurements were made.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]
(2) Sodium carbonate; Na_2CO_3; [497-19-8]
(3) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES:

T/K = 1073 & 1123
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO in the melt Na_2CO_3 - K_2CO_3 (58 - 42 mol%) at two temperatures are:

t/°C	$10^4\ C_1{}^a/\mathrm{mol\ cm^{-3}\ atm^{-1}}$
800	13.30 ± 0.9
850	20.10 ± 1.6

[a] Physical and chemical solubility of CO in the melt.

Smoothed Data:

The heat of solution, ΔH, for the solubility of CO in the melt is:

$$\Delta H/\mathrm{kJ\ mol^{-1}} = 80$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and procedure followed are described in the original publication. In brief, the melt was saturated by bubbling the gas for 2 - 3 hrs. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Carbon monoxide; CO; [630-08-0]
(2) Lithium carbonate; Li_2CO_3; [554-13-2]
(3) Sodium carbonate; Na_2CO_3; [497-19-8]
(4) Potassium carbonate; K_2CO_3; [584-08-7]

ORIGINAL MEASUREMENTS:

Appleby, A. J.; Van Drunen, C.

J. Electrochem. Soc. 1980, 127, 1655 - 59.

VARIABLES: P/kPa: 101.325 (1 atm.)

T/K = 973 - 1123

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO in the melt Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%) at different temperatures are:

t/°C	10^4 C_1^a/mol dm^{-3} atm^{-1}
700	0.86 ± 0.10
750	1.30 ± 0.10
800	1.75 ± 0.09
850	2.82 ± 0.18

[a] Physical solubility of CO in the melt.

Smoothed Data:
The temperature dependence of C_1 can be expressed by the relation:

$$\log(C_1/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -3.317 - 3655.8/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 2.9\% \quad \text{(compiler)}$$

The heat of solution, ΔH, for the solubility of CO in the melt is:

$$\Delta H/\text{kJ mol}^{-1} = 69.5$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Quenching or chilling method. The diagram and details of the apparatus used and the procedure followed have been described in the original paper. Briefly, the molten salt solvent was saturated by bubbling the gas for 2 - 3 hr. After saturation a portion of the melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated 5A Linde molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were carried out.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon monoxide;CO; [630-08-0] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8] (4) Potassium carbonate; K_2CO_3; [584-08-7]	Borucka, A.; Appleby, A. J. **J. Chem. Soc. Faraday Trans. I** 1977, 73, 1420 - 35.
VARIABLES:	PREPARED BY:
One temperature = T/K 1073	N. P. Bansal

EXPERIMENTAL VALUES:

In the molten ternary eutectic Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%), carbon monoxide dissolves in the physical as well as chemical form. At 1073K, the concentrations of physically and chemically (as CO_2^{-2}) dissolved carbon monoxide, respectively are 2.1×10^{-4} mol dm^{-3} and 1.7×10^{-3} mol dm^{-3} in equilibrium with 0.382 atm CO + 0.618 atm CO_2 gas mixture.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Steady-state polarization and rapid scan voltammetry.	Not described.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration.
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Two sudies (1,2) have been reported for the solubility of carbon dioxide in molten $LiNO_3$. The values of Paniccia and Zambonin have been obtained by extrapolating their results in $LiNO_3$ - KNO_3 mixtures. Out of the two data points, the one at 523 K is at a temperature below the melting point of $LiNO_3$. The value of K_H at 623 K is in excellent agreement with the results of Sada et al. (2). The enthalpy of solution, ΔH, reported by Sada et al. is positive while Paniccia and Zambonin reported a negative value.

Tentative values of solubility based on the results of Sada et al. (2), are given in Table 1.

Table 1

Tentative Solubilities as a Function of Temperature

T/K	10^6 K_H/mol cm^{-3} atm^{-1}
570	3.38
580	3.46
590	3.54
600	3.62
610	3.70
620	3.78
630	3.86
640	3.93
650	4.01

References:

1. Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, **69**, 2019.

2. Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, **26**, 279.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I <u>1973</u>, 69, 2019 - 25.

VARIABLES:

T/K = 523 & 623
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of carbon dioxide were measured in molten $LiNO_3$ - KNO_3 mixtures of various compositions. A linear relationship was observed between the logarithm of the solubility (x_1) and the melt compositions. The extrapolated values of x_1 in pure molten $LiNO_3$ at two temperatures are:

T/K	10^4 x_1/mol fraction bar^{-1}	10^6 K_H/mol cm^{-3} atm^{-1}
523[a]	2.1	
623	1.5	3.8[b]

[a] This temp. is below the melting point of pure $LiNO_3$ (527 K)

[b] Calculated by the compiler using density data from: G. J. Janz, **Molten Salts Handbook**, Academic Press, New York (1967).

Smoothed Data:

The enthalpy of solution, ΔH, and the standard entropy of solution, ΔS°, are reported to be:

$$\Delta H/kJ\ mol^{-1} = -9.0$$

$$\Delta S^\circ/J\ K^{-1}\ mol^{-1} = -28.0 \quad \text{(at 623 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Extrapolated from the solubility data of carbon dioxide in lithium nitrate - potassium nitrate mixtures. Solubilities in the nitrate mixtures were measured by the manometric method (1,2).

SOURCE AND PURITY OF MATERIALS:

High purity quality carbon dioxide (S.I.O., Milan) was dried in dry ice.

Reagent grade lithium nitrate (Carlo Erba, Milan) was used without further treatment.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Electroanal. Chem.** <u>1972</u>, 38, 373.
2. Zambonin, P. G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** <u>1970</u>, 28, 237.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemato, I.; Shiomi, N.

J. Chem. Eng. Data 1981, **26**, 279 - 81.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 573 - 648

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten $LiNO_3$, at different temperatures, at one atmosphere pressure are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
300	3.39
325	3.64
350	3.86
375	3.96

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.87 - 342.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.6% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 6.6 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Lithium nitrate was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

   J. Chem. Eng. Data 1980, **25**, 45.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium nitrate; $NaNO_3$;
[7631-99-4]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration.
Lewis Research Center.
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Four investigations are available (1 - 4) for the solubility of carbon dioxide in molten $NaNO_3$ using three different experimental methods. Paniccia and Zambonin (1) employed a manometric technique, Bratland and Krohn (2) chilling method, while Field and Green (3) and Sada et al. (4) used the elution technique. Smoothed data at different temperatures from various studies are compared below:

	$10^7\ K_H$/mol cm^{-3} atm^{-1}			
T/K	Ref. 1	Ref. 2	Ref. 3	Ref. 4
600	4.04	12.8	1.19	10.3
620	4.03	14.7	1.11	10.8
640	4.25	16.6	1.03	--
660		18.6	(0.97)	--

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

The results of all four investigations are quite different. Further studies are needed in order to recommend solubility values for this gas - molten salt system.

References:

1. Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, **69**, 2019.

2. Bratland, D.; Krohn, C. **Acta Chem. Scand.** 1969, **23**, 1839.

3. Field, P. E.; Green, W. J. **J. Phys. Chem.** 1971, **75**, 821.

4. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M. **J. Chem. Eng. Data** 1980, **25**, 45; Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **Ibid.** 1981, **26**, 279.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, 69, 2019 - 25.

VARIABLES:

$P/kPa = 10^2$

$T/K = 592 - 671$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, x_1, of CO_2 in molten $NaNO_3$, as a function of temperature, are presented in the form of a graph. The values of x_1 derived from the graph, by the compiler, are:

T/K	$10^5\ x_1$/ mole fraction bar^{-1}	$10^7\ K_H$/ mol cm^{-3} atm^{-1}[a]
592	1.78	4.02
607	1.80	4.05
626	1.80	4.02
639	1.91	4.24
652	1.82	4.02
671	2.00	4.39

[a] Calculated by the compiler using density data from G. J. Janz, **Molten Salts Handbook**, Academic Press, New York (1967).

Smoothed Data:

The temperature dependence of x_1 and K_H are expressed by the relations:

$\log(x_1/\text{mol fraction bar}^{-1}) = -4.304 - 267.1/(T/K)$ (compiler)

$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.055 - 204.6/(T/K)$ (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$\Delta H/\text{kJ mol}^{-1} = 4.0$

$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -25.0$ (at 623 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

Details of the experimental method are described elsewhere (1,2). Briefly, the apparatus was evacuated and carbon dioxide was introduced into the system at about one bar pressure. The initial pressure was immediately noted. The melt was vigorously stirred and the pressure variations, due to the gas dissolution, were recorded until equilibrium was attained. The final value of gas pressure was noted and Henry's law constant was calculated.

SOURCE AND PURITY OF MATERIALS:

High purity quality carbon dioxide (S.I.O., Milan) was dried in dry ice.

Reagent-grade sodium nitrate (Carlo Erba, Milan) was used without further treatment.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Electroanal. Chem.** 1972, 38, 373.
2. Zambonin, P. G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** 1970, 28, 237.

COMPONENTS: (1) Carbon dioxide; CO_2; [124-38-9] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	**ORIGINAL MEASUREMENTS:** Bratland, D.; Krohn, C. **Acta Chem. Scand.** 1969, 23, 1839 - 40.
VARIABLES: T/K = 590 - 670 P/kPa: 101.325 (1 atm.)	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in the melt are reported only in the graphical form in the temperature range 590 - 670 K. The values of Henry's law constants, K_H, extracted from the graph, at different temperatures, are:

T/K	10^6 K_H/mol ml^{-1} atm^{-1}
595	1.26
636	1.59
670	1.99

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -4.132 - 1055.2/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.3% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 20.2 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chilling method.

The experimental method has been described in detail elsewhere (1,2). The melt is saturated with the gas. The dissolved gas is separated from the salt by freezing the melt. The expelled carbon dioxide is measured by transporting it by a stream of pure argon into absorption vessels containing Ascarite/Dehydrite.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.95%) was obtained from Oslo Kulsyrefabric A/S.

Sodium nitrate of pro analysi grade was obtained from E. Merck A. G. and Riedel de Haen A. G. Sodium nitrate was vacuum dried at 450°C for 12 hrs.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, 19, 13.
2. **Ibid. Acta Chem. Scand.** 1966, 20, 1811.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Field, P. E.; Green, W. J.
J. Phys. Chem. 1971, 75, 821 - 25.
Green, W. J.
Ph. D. Thesis, Virginia Polytechnic Institute 1969.

VARIABLES:

T/K = 587 - 639
P/kPa = 93.219 - 121.59

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed over the pressure range studied (0.92 - 1.20 atm). The values of Henry's law constant, K_H, at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
587	1.251
589	1.255
614	1.117
636	1.077
639	1.024

Smoothed Data:
The temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = (-7.90 \pm 0.04) + (585.08 \pm 0.03)/(T/K)$$

std. dev. = 0.16%

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kcal mol}^{-1} = (-2.68 \pm 0.12)$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = (-14.55 \pm 0.20) \quad \text{(at 637 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram of the gas solubility apparatus is given in the original publication.

The experimental operation consisted of three steps: saturation, elution and analysis. After saturating the melt with carbon dioxide gas, the gas phase was evacuated. Helium was introduced into the system as eluting gas to approximately 1 atm. pressure. The resultant gas mixture of carbon dioxide and helium was analyzed with an Aerograph 90-P gas chromatograph (Varian). The carrier gas used was also helium. Average of four measurements was used for calculation of the gas solubility.

SOURCE AND PURITY OF MATERIALS:

Matheson Bone Dry carbon dioxide and helium obtained from Airco were used directly from the cylinders.

Baker's reagent grade sodium nitrate was used without further purification.

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H,; Kayano, M. **J. Chem. Eng. Data** 1980, 25, 45 - 47.
2. Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **Ibid.** 1981, **26**, 279 - 81.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 583 - 623

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten $NaNO_3$, at different temperatures, at one atmosphere pressure are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
310	1.07
330	1.03
350	1.08

The gas solubility in molten sodium nitrate appears to be independent of temperature in the range studied.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the solubility apparatus are given in the original paper. The melt was saturated with CO_2 by bubbling the gas through the melt for about 50 min. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The concentration of carbon dioxide in the eluted mixture was determined with an infrared carbon dioxide analyzer (Shimadzu, Type URA-25).

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was superpure grade and free from water.

Sodium nitrate was of reagent grade. It was dried in a dessicator for a few days followed by drying in a vacuum oven at 423 - 473 K drying for several hours. It was further dried by bubbling anhydrous nitrogen through the molten salt.

ESTIMATED ERROR:

std. error in solubility: < ± 10%

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium nitrate; KNO_3; [7757-79-1]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration.
Lewis Research Center.
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Three investigations are available (1 - 3) for the solubility of carbon dioxide in molten KNO_3 employing two different experimental methods. Smoothed data at different temperatures from the three studies are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}		
T/K	Ref. 1	Ref. 2	Ref. 3
620	2.83		1.59
640	2.85	10.5	1.50
670	2.95	11.1	1.38
ΔH/kJ mol^{-1}	+ 3.0	--	- 10.0

The solubility values of the three investigations are quite different. The ΔH values are not only different in magnitude, but also opposite in sign.

Further experimental studies are required before this system can be properly evaluated and recommended values can be advanced.

References:

1. Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, **69**, 2019.

2. Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, **26**, 279.

3. Green, W. J. **Ph. D. Thesis**, Virginia Polytechnic Institute 1969.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, **69**, 2019 - 25.

VARIABLES:

$P/kPa = 10^2$
$T/K = 616 - 670$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, x_1, of CO_2 in molten KNO_3 at different temperatures are reported in graphical form. The values of x_1 derived from the graph, by the compiler, are:

T/K	$10^5\ x_1$/ mol fraction bar^{-1}	$10^7\ K_H$/ mol cm^{-3} atm^{-1}[a]
616	1.54	2.88
628	1.46	2.72
640	1.54	2.85
670	1.61	2.95

[a] Calculated by the compiler using density data from: G. J. Janz **"Molten Salts Handbook"** Academic Press, New York (1967).

Smoothed Data:

The temperature dependence of x_1 and K_H are expressed by the relations:

$$\log(x_1/\text{mol fraction bar}^{-1}) = -4.473 - 217.3/(T/K) \quad \text{(compiler)}$$

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.308 - 149.1/(T/K) \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kJ mol}^{-1} = 3.0$$
$$\Delta S°/\text{J K}^{-1}\ \text{mol}^{-1} = -31.0 \quad \text{(at 623 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The experimental procedure has been described in detail elsewhere (1,2). In brief, the apparatus was evacuated and then carbon dioxide was introduced into the system at about one bar pressure. The initial gas pressure was immediately noted. The melt was vigorously stirred and the fall in gas pressure due to its solubility in the melt was recorded till equilibrium was attained. The final gas pressure was noted and Henry's constant was evaluated.

SOURCE AND PURITY OF MATERIALS:

High purity quality carbon dioxide (S.I.O., Milan) was dried in dry ice.

Reagent grade potassium nitrate (Carlo Erba, Milan) was used without further purification.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni. E.; Paniccia, F.; Zambonin, P.G.
J. Electroanal. Chem. 1972, **38**, 373.
2. Zambonin, P. G.; Cardetta, V.L.; Signorile, G.
J. Electroanal. Chem. 1970, **28**, 237.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium nitrate; KNO_3; [7757-79-1]	Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, **26**, 279 - 81.
VARIABLES: P/kPa: 101.325 (1 atm.) T/K = 643 - 673	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten KNO_3, at different temperatures, at one atmosphere pressure are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
370	1.06
375	1.20
400	1.12

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was superpure grade and free from water

Potassium nitrate used was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

   J. Chem. Eng. Data 1980, **25**, 45.

COMPONENTS:

(1) Carbon dioxide, CO_2; [124-38-9]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Green, W. J.

Ph. D. Thesis, Virginia Polytechnic Institute 1969.

VARIABLES:

T/K = 611 - 669

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of CO_2 in molten KNO_3, Henry's law was obeyed only upto the pressure of 200 torr. The experimental data in this pressure range was only used in calculating the thermodynamic parameters and the reported solubilities. The values of Henry's law constant, K_H, at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
611	0.57
613	1.37
614	1.64
615	1.10
624	1.83
625	1.01
631	1.50
633	1.31
643	0.97
646	1.75
654	1.19
667	1.40
669	1.03

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the gas solubility apparatus are given in the original publication.

The experimental process consisted of three steps: saturation, elution and analysis. After saturating the melt with carbon dioxide, the gas phase was evacuated. Helium was introduced into the system as eluting gas to approximately 1 atm. pressure. The resultant gas mixture of carbon dioxide and helium was analyzed with an Aerograph Model 90-P gas chromatograph (Varian). The carrier gas used was also helium.

SOURCE AND PURITY OF MATERIALS:

Matheson Bone Dry carbon dioxide and helium obtained from Airco were used directly from the cylinders.

Source and purity of KNO_3 not described.

ESTIMATED ERROR:

$\delta C/P = \pm 5\%$ (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium nitrate; KNO_3; [7757-79-1]	Green, W. J. **Ph. D. Thesis**, Virginia Polytechnic Institute 1969.
VARIABLES:	PREPARED BY:
	N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -7.604 + 499.06/(T/K)$$

$$\text{std. dev.} = 0.52\%$$

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kcal mol}^{-1} = -2.28 \pm 0.44$$

$$\Delta S/\text{cal K}^{-1}\ \text{mol}^{-1} = -13.11 \pm 0.69 \quad (\text{at } 670\ K)$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Rubidium nitrate; $RbNO_3$; [13126-12-0]	Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, **26**, 279 - 81.
VARIABLES: P/kPa: 101.325 (1 atm.) T/K = 623 - 723	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten $RbNO_3$, at different temperatures, at one atmosphere pressure are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
350	1.88
400	1.78
450	1.77

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.921 + 119.2/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.8% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -2.3 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.
The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.
Rubidium nitrate was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, **25**, 45.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Cesium nitrate; $CsNO_3$; [7789-18-6]	Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, **26**, 279 - 81.
VARIABLES: P/kPa: 101.325 (1 atm.) T/K = 723 - 773	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten $CsNO_3$, at different temperatures, at one atmosphere pressure are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
450	9.60
475	8.10
500	9.30

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of CO_2 in the eluted gas mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Cesium nitrate was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45.

COMPONENTS:	EVALUATOR:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Sodium chloride; NaCl; [7647-14-5]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center. Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Six studies (1 - 6) are available for the solubility of carbon dioxide in molten NaCl. Values of refs. 1 and 2 are too high by about an order of magnitude, probably, due to the formation of nickel oxide from the nickel containers which reacts with carbon dioxide to form carbonate ions (3). These two investigations are, therefore, rejected. Smoothed data at different temperatures from the remaining four studies are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}			
T/K	Ref. 3	Ref. 4	Ref. 5	Ref. 6[c]
1100	5.20	5.18	--	--
1130	5.59	5.57	--	7.10
1160	5.98	5.97	--	7.51
1190	6.37	6.37	--	7.92
1220	6.77	6.78	9.9[a]	8.31
1250	7.18	7.20	--	8.72
1270	7.45	7.48	10.1[b]	8.98

[a] At 1223 K
[b] At 1273 K
[c] Values in (mol cm^{-3} atm^{-1}) were calculated by the evaluator using density data from Janz, G. J. **"Molten Salts Handbook"**, Academic Press, New York, 1967.

The studies (3,4) are from the same group of workers using the same techniques and their results are lower compared to the other two investigations. The values of Bezukladnikov et al. (6) are 10 - 15% lower than those of Sada et al. (5).

Further studies are needed in order to advance recommended solubility values for this gas - molten salt system.

References:

1. Grjotheim, K.; Heggelund, P.; Krohn, C.; Matzfeld, K. **Acta Chem. Scand.** 1962, 16, 689.
2. Krohn, C, **Tidsskr. Kjemi. Bergv. Met.** 1962, 22, 207.
3. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeld, K. **Acta Chem. Scand.** 1966, 20, 1811.
4. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeld, K. **J. Metals** 1967, 19, 13.
5. Sada, E.; Katoh, S.; Yoshii, H.; Takemato, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, 26, 279.
6. Bezukladnikov, A, B.; Devyatkin, V. N.; Ll'cheva, O. N. **Russ. J. Phys. Chem.** 1970, 44, 139.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

1. Grjotheim, K.; Heggelund, P.; Krohn, C.; Matzfeldt, K. **Acta Chem. Scand.** 1962, 16, 689 - 94.
2. Krohn, C. **Tidsskr. Kjemi, Bergv, Met.** 1962, 22, 207 -10.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1085 - 1221

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 at 1 atm. pressure at different temperatures are:

t/°C	10^6 K_H/mol ml^{-1} atm^{-1}
812.2	4.20
813.0	4.81
829.8	4.14
830.4	4.18
852.0	5.07
903.9	5.47
948.3	5.71

Smoothed Data:

Temperature dependence of the Henry's law constant, K_H, is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -4.19 - 1273.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 3.4% (compiler)

The heat of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = 29.7$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The technique was essentially the same as used by Grimes et al. (1). The detailed description of the apparatus and procedure is given in the original paper. This method is basically the elution technique. The melt was saturated with carbon dioxide by bubbling the gas through it. A part of this saturated molten salt was transferred to the stripping section and stripped of its CO_2 - content by bubbling pure nitrogen. The amount of CO_2 was determined by absorption in Ascarite.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G.

J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

Acta Chem. Scand. 1966, **20**, 1811 - 26.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1074 - 1270

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 at 1 atmosphere CO_2 pressure at different temperatures are:

t/°C	10^7 K_H/mol ml^{-1} atm^{-1}
801	5.9 ± 0.64[a]
829	5.20 ± 0.35
862	5.64 ± 0.29
904	6.19 ± 0.20
951	6.89 ± 0.56
997	7.58 ± 0.47

[a] By volumetric method; rest by chilling method.

Smoothed Data:

Temperature dependence of Henry's law constant, K_H, is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -5.12 - 1280/(T/K) \quad \text{(compiler)}$$

std. dev. = 3.2% (compiler)

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Three different techniques have been used: volumetric, thermogravimetric and chilling method. Detailed description of each technique is given in the original publication.
Volumetric Method: The change in volume of the gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not a very accurate method and was finally abandoned. The estimated uncertainty in the results was about 25%.
Thermogravimetric Method: The gain in the weight of the melt sample due to the dissolution of the gas is determined using a balance.
Chilling Method: It employs the separation of the dissolved gas from the salt by freezing of

continued

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide - not mentioned.
Sodium chloride was of pro analysi quality from E. Merck A. G. In the volumetric and thermogravimetric measurements, the salt was dried in situ, whereas in the chilling method, the salt was dried under vacuum at 450°C for 4 hrs.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Sodium chloride; NaCl; [7647-14-5]	Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **Acta Chem. Scand.** 1966, 20, 1811 - 26.
VARIABLES:	PREPARED BY:
T/K = 1074 - 1270	N. P. Bansal

EXPERIMENTAL VALUES:

continued

The heat of dissolution, ΔH, and the entropy of dissolution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 24.7$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = 21.3 \quad \text{(at 1150 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

continued

the melt. The expelled carbon dioxide is carried into the absorption vessel by a stream of pure nitrogen. This method is less cumbersome and more expedient than the other two but with comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2;
[124-38-9]

(2) Sodium chloride; NaCl;
[7647-14-5]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.;
Krohn, C.; Matzfeldt, K.

J. Metals 1967, **19**, 13 - 20.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1100 - 1285

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 in molten sodium chloride at different temperatures are reported in the form of a log K_H vs. 1/T plot. Values of K_H derived from the plot, by the compiler, at different temperatures are presented below:

T/K	10^7 K_H/mol ml^{-1} atm^{-1}
1101	5.2 ± 0.2
1133	5.6 ± 0.3
1176	6.2 ± 0.2
1223	6.8 ± 0.4
1285	7.7 ± 0.5

Smoothed Data:
Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -5.094 - 1311/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.15\% \quad \text{(compiler)}$$

The heat of dissolution, ΔH, and entropy of dissolution, ΔS, are:

ΔH/kJ mol^{-1} = 25.94 ΔS/J K^{-1} mol^{-1} = 22.6 (at 1150 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Four different techniques have been employed. Detailed description of the apparatus and procedure for each method are given in the original paper. Stripping Method: The melt is saturated with the gas. The dissolved gas is stripped with an inert gas and absorbed in Ascarite. This method gave results about an order of magnitude higher than those obtained by all other methods. Volumetric Method: The change in volume of gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not an accurate method, the estimated uncertainty being about 25%. Thermogravimetric Method: The gain in the weight of the melt sample due to the dissolution of

continued

SOURCE AND PURITY OF MATERIALS:

Sodium chloride, pro analysi quality, from Merck AG, Darmstadt, West Germany was used. It was either dried in situ (volumetric and thermogravimetric methods) or pre-dried in vacuum at 450°C for 4 hrs. (chilling method).

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Sodium chloride; NaCl; [7647-14-5]	Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. J. Metals 1967, 19, 13 - 20.
VARIABLES:	PREPARED BY:
T/K = 1100 - 1285	N. P. Bansal

EXPERIMENTAL VALUES:

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

continued

the gas is measured using a thermobalance.
Chilling Method: The dissolved gas is removed from the melt by freezing of the melt. The expelled gas is carried into absorption vessels containing Ascarite/Dehydrite by a stream of pure argon. This method is simpler and more expedient than the others but giving comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data 1981, 26, 279 - 81.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1208 - 1273

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at 1 atmosphere pressure are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
935	8.33
950	9.78
970	8.74
1000	9.08

Smoothed Data:

Temperature dependence of K_H is given by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.758 - 358.3/(T/K)$$ (compiler)

std. dev. = 3.5% (compiler)

The enthalpy of solution, ΔH, is estimated to be:

ΔH/kJ mol^{-1} = 6.9 (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Dissolved gas in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Potassium chloride was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Sodium chloride; NaCl; [7647-14-5]	Bezukladnikov, A. B.; Devyatkin, V. N.; Ll'icheva, O. N. **Zh. Fiz. Khim.** 1970, **44**, 253 - 54; **Russ. J. Phys. Chem.** (Eng. Transl.) 1970, **44**, 139. (*).
VARIABLES: P/kPa: 101.325 (compiler) T/K = 1133 - 1273	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Solutions of carbon dioxide in molten NaCl obey Henry's law. The temperature dependence of solubility, x_1 (mol fraction), in the range 1133 - 1273 K, is expressed by the relations:

$$x_1(\text{mol fraction}) = 36.1 \times 10^{-5} \exp[-5804\ \text{cal}/RT]$$

$$\log(x_1/\text{mol fraction}) = -3.4425 - 1268.6/(T/K) \quad \text{(compiler)}$$

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = +24.28$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Elution method. Carbon dioxide is bubbled through the melt till saturated. The dissolved gas is displaced by flushing with an inert gas. The liberated CO_2 is absorbed in barium hydroxide solution. The excess of barium hydroxide is titrated with potassium hydrogen phthalate.	Not reported.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl;
[7447-40-7]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space
Administration
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

Seven investigations (1 - 7) have been reported for the solubility of carbon dioxide in molten KCl. Results of refs. 1 and 2 are too high by almost an order of magnitude, probably, due to the formation of nickel oxide from the nickel containers which reacts with carbon dioxide to form carbonate ions (4). These two studies are, therefore, rejected. Smoothed data from the remaining sources at different temperatures are presented below for comparison:

	$10^7\ K_H$/mol cm^{-3} atm^{-1}				
T/K	Ref. 3	Ref. 4	Ref. 5	Ref. 6	Ref. 7[a]
1070	6.50	6.37	(7.42)	--	(7.35)
1100	6.88	6.75	7.70	--	(7.75)
1130	7.27	7.12	7.99	(8.41)	8.14
1160	7.65	7.50	8.26	(8.57)	8.53
1190	8.04	7.88	8.53	(8.73)	8.90
1220	8.42	8.26	8.80	8.88	9.27
1250	8.80	8.63	(9.06)	9.02	9.62
1280	(9.18)	(9.00)	(9.32)	(9.16)	9.97
1300	(9.43)	(9.25)	--	(9.26)	10.19
1320	(9.69)	(9.50)	--	--	10.41

[a] Values in (mol cm^{-3} atm^{-1}) calculated by the evaluator using density data from Ganz, G. J. "Molten Salts Handbook", Academic Press, New York, 1967.

Values in ( ) outside the temperature interval of experimental measurement; extrapolated by the evaluator.

The studies (3,4) are from the same group of workers using the same techniques and their results are consistently low by about 10% in comparison to the values of Bezukladnikov et al. (7). The results of (5,6,7) agree with each other in certain temperature ranges but differ at other temperatures due to the difference in the values of ΔH reported by them.

Additional investigations are required in order to advance recommended solubility values for this system.

References:

1. Grjotheim, K.; Heggelund, P.; Krohn, C.; Matzfeldt, K. **Acta Chem. Scand.** 1962, **16**, 689.
2. Krohn, C. **Tidsskr. Kjemi, Bergv. Met.** 1962, **22**, 207.
3. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, **19**, 13.
4. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **Acta Chem. Scand.** 1966, **20**, 1811.
5. Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Russ. J. Phys. Chem.** 1972, **46**, 1398.
6. Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, **26**, 279.
7. Bezukladnikov, A. B.; Devyatkin, V. N.; Ll'icheva, O. N. **Russ. J. Phys. Chem.** 1970, **44**, 139.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

1. Grjotheim, K.; Heggelund, P.; Krohn, C.; Matzfeldt, K.
Acta Chem. Scand. 1962, 16, 689 - 94.
2. Krohn, C.
Tidsskr. Kjemi, Bergv., Met. 1962, 22, 207 - 10.

VARIABLES: P/kPa: 101.325 (1 atm.)
T/K = 1064 - 1243

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 at 1 atm pressure at different temperatures are:

t/°C	10^6 K_H/mol ml^{-1} atm^{-1}
791.0	2.73
792.9	3.02
802.0	2.78
823.5	3.76
835.5	4.14
863.1	5.26
876.4	4.02
903.0	4.65
925.0	6.81
969.9	8.90

Smoothed Data:

Temperature dependence of the Henry's law constant, K_H, is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -2.339 - 3415.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 5.7% (compiler)

The heat of solution, ΔH, is: ΔH/kJ mol^{-1} = 61.9

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The technique used was essentially the same as used by Grimes et al. (1). The detailed description of the apparatus and procedure is given in the original publication. This method is basically the elution technique. The melt was saturated with carbon dioxide by bubbling the gas through it. A part of this saturated molten salt was transferred to the stripping section and stripped of its CO_2 - content by bubbling pure nitrogen. The amount of CO_2 was determined by absorption in Ascarite.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.
J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

J. Metals 1967, 19, 13 - 20.

VARIABLES:

T/K = 1074 - 1276
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 in fused KCl are reported in the form of a log K_H vs. 1/T plot. Values of K_H at different temperatures derived from the plot, by the compiler, are given below:

T/K	10^7 K_H/mol ml^{-1} atm^{-1}
1074	6.5 ± 0.3
1123	7.2 ± 0.2
1188	8.0 ± 0.3
1224	8.6 ± 0.2
1276	9.0 ± 0.1

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -5.272 - 979.3/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.6% (compiler)

The heat of solution, ΔH, and entropy of dissolution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 19.7$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = 17.2 \quad \text{(at 1150 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Four different techniques have been employed. Detailed description of the apparatus and procedure for each method are given in the original paper.
Stripping Method: The melt is saturated with the gas. The dissolved gas is stripped with an inert gas and absorbed in Ascarite. This method gave results about an order of magnitude higher than those obtained by all other methods.
Volumetric Method: The change in volume of gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not an accurate method, the estimated uncertainty being about 25%.
Thermogravimetric Method: The gain in the weight of the melt

continued

SOURCE AND PURITY OF MATERIALS:

Potassium chloride, pro analysi quality, from Merck AG, Darmstadt, West Germany, was used. It was either dried in situ (volumetric and thermogravimetric methods) or pre-dried in vacuum at 450°C for 4 hrs. (chilling method).

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.;
Krohn, C.; Matzfeldt, K.

J. Metals 1967, **19**, 13 - 20.

VARIABLES:

T/K = 1074 - 1276

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

continued

sample due to the dissolution of the gas is measured using a thermobalance.
Chilling Method: The dissolved gas is removed from the melt by freezing of the melt. The expelled gas is carried into absorption vessels containing Ascarite/Dehydrite by a stream of pure argon. This method is simpler and more expedient than the others but giving comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

Acta Chem. Scand. 1966, 20, 1811 - 26.

VARIABLES:

$T/K = 1049 - 1275$

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 at different temperatures at 1 atm. pressure are:

t/°C	10^7 K_H/mol ml^{-1} atm^{-1}
776	7.2 ± 1.8 [a]
799	6.45 ± 0.23
851	7.15 ± 0.20
903	7.90 ± 0.01
912	8.03 ± 0.24
952	8.57 ± 0.21
1002	8.95 ± 0.19

[a] By volumetric method; other values by chilling method.

Smoothed Data:

Temperature dependence of the Henry's law constant, K_H, is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -5.28 - 980/(T/K)$$

std. dev. = 2.2% (compiler)

The heat of dissolution, ΔH, and the entropy of dissolution, ΔS, are:

$\Delta H/\text{kJ mol}^{-1} = 18.8$ $\Delta S/\text{J K}^{-1}\ \text{mol}^{-1} = 16.3$ (at 1150 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Detailed description of each technique is given in the original publication.

Volumetric Method: The change in volume of the gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not a very accurate method and was finally abandoned. The estimated uncertainty in the results was 25%

Thermogravimetric Method: The gain in the weight of the melt sample due to the dissolution of the gas is determined using a balance.

Chilling Method: It employs the separation of the dissolved gas from the salt by freezing of the melt. The expelled CO_2 is carried into the absorption vessel by a stream of pure nitrogen. This method is less cumbersome and more expedient than the other two but the accuracy is comparable or better.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide - not mentioned.

Potassium chloride was of *pro analysi* grade from E. Merck A. G. in the volumetric and thermogravimetric measurements, the salt was dried *in situ*, whereas in the chilling method, the salt was dried under vacuum at 450°C for 4 hrs.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium chloride; KCl; [7447-40-7]	Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Zh. Fiz. Khim.** 1972, **46**, 2433 - 36; **Russ. J. Phys. Chem.** (Eng. Transl.) 1972, **46**, 1398 - 1400. (*).
VARIABLES: P/kPa: 101.325 (compiler) T/K = 1078 - 1223	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten KCl at different temperatures are:

T/K	10^4 Soly./M
1078	7.50
1120	7.93
1175	8.41
1223	8.84

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(\text{Soly/mol cm}^{-3}) = -5.526 - 646/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.14% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 12.4 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

The diagram and details of the apparatus used and procedure followed are given in the original paper. In brief, the melt is saturated with carbon dioxide. A portion of the saturated melt is either sparged with argon or it is solidified and the solid salt evacuated. The volume of liberated CO_2 is then determined with a gas burette.

SOURCE AND PURITY OF MATERIALS:

Condensation method was employed for drying the gases.

ESTIMATED ERROR:

solubility = ± 1% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data 1981, **26**, 279 - 81.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1208 - 1273

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at 1 atmosphere pressure are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
935	8.33
950	9.78
970	8.74
1000	9.08

Smoothed Data:

Temperature dependence of K_H is given by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.758 - 358.3/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 3.5\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 6.9 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Dissolved gas in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Potassium chloride was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, **25**, 45.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium chloride; KCl; [7447-40-7]	Bezukladnikov, A. B.; Devyatkin, V. N.; Ll'icheva, O. N. **Zh. Fiz. Khim.** 1970, **44**, 253 - 54; **Russ. J. Phys. Chem.** (Eng. Transl.) 1970, **44**, 139. (*).
VARIABLES: P/kPa: 101.325 (compiler) T/K = 1133 - 1323	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Solutions of carbon dioxide in molten KCl obey Henry's law. The temperature dependence of solubility, x_1 (mol fraction), in the range 1133 - 1323 K, is expressed by the equations:

$$x_1(\text{mol fraction}) = 38.9 \times 10^{-5} \exp[-5047\ \text{cal}/R(T/K)]$$

$$\log(x_1/\text{mol fraction}) = -3.410 - 1103.1/(T/K) \quad \text{(compiler)}$$

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = +\ 21.12$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Elution method. Carbon dioxide is bubbled through the melt till saturated. The dissolved gas is displaced by flushing with an inert gas. The liberated CO_2 is absorbed in barium hydroxide solution. The excess barium hydroxide is titrated with potassium hydrogen phthalate.	Not reported.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data <u>1981</u>, 26, 279 - 81.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 1123 - 1223

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities, K_H, at a pressure of one atmosphere are:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
850	6.09
950	6.63
950	7.31

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.247 - 1087.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.4% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 20.8 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as decribed in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Gas dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Rubidium chloride was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

   J. Chem. Eng. Data <u>1980</u>, 25, 45.

COMPONENTS:

(1) Carbon dioxide; CO_2;
[124-38-9]

(2) Cesium chloride; CsCl;
[7647-17-8]

ORIGINAL MEASUREMENTS:

Bezukladnikov, A. B.; Devyatkin,
V. N.; Ll'icheva, O. N.
Zh. Fiz. Khim. 1970, **44**, 253 - 54;
Russ. J. Phys. Chem. (Eng. Transl.)
1970, **44**, 139. (*).

VARIABLES:

P/kPa: 101.325 (compiler)

T/K = 1060 - 1230

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solutions of carbon dioxide in molten CsCl obey Henry's law. The temperature dependence of solubility, x_1 (mol fraction), in the range 1060 - 1230 K, is expressed by the equations:

$$x_1\text{(mol fraction)} = 108.4 \times 10^{-5} \exp[-6434 \text{ cal}/R(T/K)]$$

$$\log(x_1/\text{mol fraction}) = -2.965 - 1406.3/(T/K) \quad \text{(compiler)}$$

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = + 26.92$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.
Carbon dioxide is bubbled through the melt till saturated. The dissolved gas is displaced by sparging with an inert gas. The liberated CO_2 is absorbed in barium hydroxide solution. The excess of barium hydroxide is titrated with potassium hydrogen phthalate.

SOURCE AND PURITY OF MATERIALS:

Not reported.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2;[124-38-9]

(2) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES: P/kPa: 101.325 (compiler)
T/K = 1023 - 1223

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol $cm^{-3}atm^{-1}$), in the melt at various temperatures are given below, where K_p is the Henry's law constant.

T/K	10^6 K_p/mol cm^{-3} atm^{-1}
1023	5.69 ± 0.51
1073	4.52 ± 0.44
1123	3.55 ± 0.25
1273	3.18 ± 0.20
1223	3.00 ± 0.22

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -7.164 + \frac{1947}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

Experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $MgCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt.

Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K.

CO gas was produced through decomposition of formic acid.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2;[124-38-9]

(2) Calcium chloride; $CaCl_2$; [10043-52-4]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES:

P/kPa: 101.325 (compiler)

T/K = 1073 - 1123

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol $cm^{-3}atm^{-1}$), in the melt at various temperatures are given below, where K_p is the Henry's law constant.

T/K	10^7 Kp/mol cm^{-3} atm^{-1}
1073	3.49 ± 0.37
1100	3.19 ± 0.39
1123	2.96 ± 0.32

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -7.061 + \frac{1720}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $CaCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt. Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K. CO_2 was purified to remove moisture and O_2 by passing over P_2O_5 and heated copper shavings

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon Dioxide; CO_2;[124-38-9]

(2) Strontium chloride; $SrCl_2$; [10476-85-4]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 1173 - 1323

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol $cm^{-3}atm^{-1}$), in the melt at various temperatures are given below, where K_p is the Henry's law constant.

T/K	10^6 K_p/mol cm^{-3} atm^{-1}
1173	3.06 ± 0.27
1213	2.81 ± 0.29
1253	2.41 ± 0.17
1293	2.00 ± 0.19
1323	2.04 ± 0.18

Temperature dependence of K_p could be expressed by the relation :

$$\log K_p = -6.821 + \frac{1517}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $SrCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt.

Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K.

CO gas was produced through decomposition of formic acid.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon Dioxide; CO_2;[124-38-9]

(2) Barium chloride; $BaCl_2$; [10361-37-2]

ORIGINAL MEASUREMENTS:

Prutskov, D. V.; Krivoruchko, N. P.; Prisyashnyi, V. D.
Rasplavy 1988, 2, 70 - 73.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 1253 - 1373

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities, K_p(mol $cm^{-3}atm^{-1}$), in the melt at various temperatures are given below, where K_p is the Henry's law constant

T/K	10^6 K_p/mol cm^{-3} atm^{-1}
1253	1.86 ± 0.23
1293	1.84 ± 0.15
1333	1.89 ± 0.22
1373	1.92 ± 0.17

Temperature dependence of K_p can be expressed by the relation :

$$\log K_p = -5.543 - \frac{293}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The melt was prepared by melting the chloride under dry HCl atmosphere. The melt was saturated with CO gas by bubbling at the rate of 3-5 lit/h. It was established that saturation was attained in 50-60 min. Argon was bubbled at the rate of 6-9 lit/h through the saturated melt to liberate the dissolved CO gas. In order to determine the amount of dissolved CO, it was oxidized to CO_2 by passing over powdered CuO at 800 - 900 K. The resulting CO_2 was absorbed in 0.0175M $Ba(OH)_2$ solution excess of which was titrated against potassium bipthalate.

The experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

High purity $BaCl_2$ was recrystallized twice from doubly distilled water and dried in a vacuum oven without permitting melting of the hydrated salt. Argon gas was purified to remove H_2O and O_2 by passing through columns containing P_2O_5 and titanium sponge heated at 1200 K. CO_2 was purified to remove moisture and O_2 by passing over P_2O_5 and heated copper shavings.

ESTIMATED ERROR:

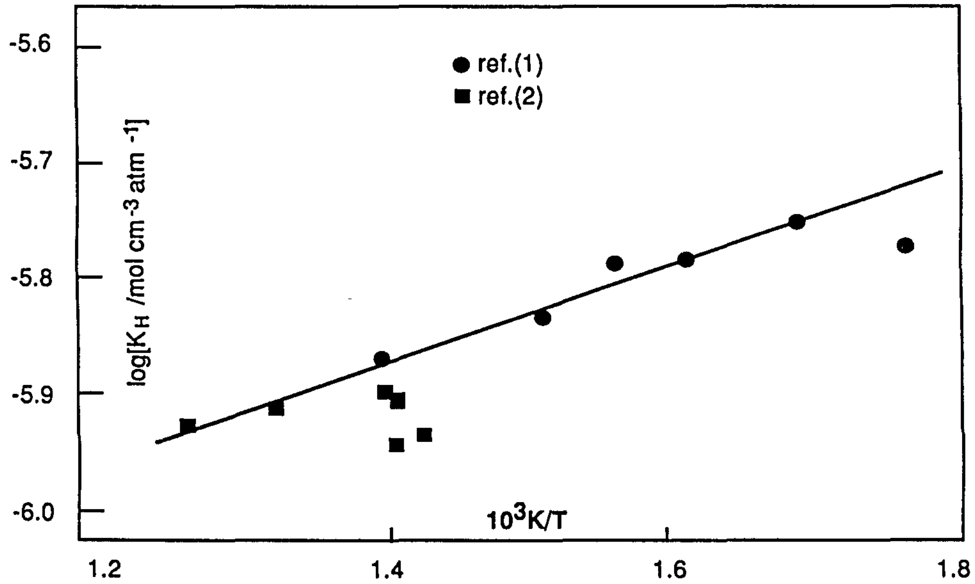
Not specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Zinc chloride; $ZnCl_2$; [7646-85-7]	N. P. Bansal National Aeronautic and Space Administration. Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Two studies are available (1,2) for the solubility of carbon dioxide in molten $ZnCl_2$. Sada et al. (1) used the elution technique while Borodzinski et al. (2) employed a volumetric method. The results at different temperatures from the two investigations are compared in Fig. 1.



At higher temperatures, Fig. 1 shows an excellent agreement between the results of the two studies. However, Sada et al. (1) reported a negative value for ΔH, in contrast to a positive value given by Borodzinski, et al. Tentative solubilities based on the results of Sada et al. (1) are given in Table 1. However, additional studies are needed in order to advance recommended values of solubility for this system.

Table 1
Tentative Solubilities as a Function of Temperature

T/K	10^6 K_H/mol cm^{-3} atm^{-1}
580	1.82
600	1.74
620	1.67
640	1.61
660	1.55
680	1.50
700	1.45
720	1.41
740	1.37
760	1.33
780	1.30

References:
1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M. J. **Chem. Engg. Data** 1980, 25, 45.
2. Borodzinski, A.; Sokolowski, A.; Suski, L. J. **Chem. Thermodyn.** 1975, 7, 655.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Zinc chloride; $ZnCl_2$; [7646-85-7]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45 - 47.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 573 - 723

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at 1 atmosphere pressure are given as:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
300	1.76
325	1.80
350	1.71
375	1.65
400	1.47
450	1.38

Smoothed Data:

Temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.31 + 330.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.8% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -6.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

Diagram and details of the solubility apparatus are given in the original paper. The melt was saturated with CO_2 by bubbling the gas through the melt for about 50 min. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of CO_2 in the eluted mixture was determined with an infrared carbon dioxide analyzer (Shimadzu, Type URA-25).

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was superpure grade and free from water.

Zinc chloride was of reagent grade. It was dried in a desiccator for a few days and also in a vacuum oven at 150 - 250°C for several hours. It was further dried by bubbling anhydrous nitrogen through the salt in the molten state.

ESTIMATED ERROR:

std. error in solubility: < ± 10%

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Zinc chloride; $ZnCl_2$; [7646-85-7]

ORIGINAL MEASUREMENTS:

Borodzinski, A.; Sokolowski, A.; Suski, L.

J. Chem. Thermodyn. 1975, 7, 655 - 60.

VARIABLES:

P/kPa = 10 - 100

T/K = 709 - 778

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 in the melt at different temperatures are:

T/K	10^{10} x_1/mol fraction Pa^{-1}	10^6 $K_H{}^a$/mol ml^{-1} atm^{-1}
709	6.52 ± 0.06	1.127
719	6.41 ± 0.20	1.106
721	7.04 ± 0.21	1.214
723	7.27 ± 0.50	1.253
753	7.40 ± 0.30	1.268
778	7.46 ± 0.50	1.271

[a] Values of K_H calculated by the compiler using density of $ZnCl_2$ from Janz, G. J. **"Molten Salts Handbook"** Academic Press, 1967.

Smoothed Data:

Temperature dependence of the Henry's law constant is given by the equations:

$$\log(x_1/\text{mol fraction Pa}^{-1}) = -8.535 - 454/(T/K) \quad \text{(compiler)}$$
$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -5.357 - 411.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.1% (compiler)

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, of solution of the gas are:

$$\Delta H°/\text{kJ mol}^{-1} = 8.74 \pm 3.68$$
$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -9.58 \pm 5.02 \quad \text{(at 720 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

Diagram and details of the arrangement used are given in the original paper. The melt was saturated with the gas. The saturation process was enhanced by a magnetic stirrer. The change in the volume of the gas caused by its dissolution in the melt was determined. The temperature was controlled within ± 1 K.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide was 99.99% pure.

Zinc chloride p.a. was distilled under vacuum prior to its distillation directly into the apparatus.

ESTIMATED ERROR:

solubility = ± 5% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Stannous chloride; $SnCl_2$; [7772-99-8]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45 - 47.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 543 - 673

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at one atmosphere pressure are given as:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
270	3.86
300	4.01
350	3.96
400	3.75

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.474 + 38.296/(T/K)$$ (compiler)

std. dev. = 1.4% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -0.73$$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the solubility apparatus are described in the original publication. The melt was saturated with carbon dioxide by bubbling the gas through the melt for about 50 min. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was determined with an infrared carbon dioxide analyzer (Shimadzu, Type URA-25).

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was superpure grade and free from water.

Stannous chloride was of reagent grade. It was dried in a desiccator for a few days followed by in a vacuum oven at 150 - 200°C for several hours. It was further dried by bubbling anhydrous nitrogen through the salt in the molten state.

ESTIMATED ERROR:

std. error in solubility: < ± 10%

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium fluoride; NaF; [7681-49-4]

ORIGINAL MEASUREMENTS:

Bratland, D.; Krohn, C.

Acta Chem. Scand. 1969, 23, 1839 - 40.

VARIABLES:

T/K = 1270 - 1380
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The authors reported the solubilities of CO_2 in the melt in the temperature interval 1270 - 1380 K in graphical form only. The values of Henry's law constants, K_H, extracted from the graph, at different temperatures are:

T/K	10^6 K_H/mol ml^{-1} atm^{-1}
1273	1.88[a]
1281	1.99
1313	2.59
1383	5.01

[a] Value from thermogravimetric technique; rest by chilling method.

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -0.3436 - 6863.4/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.4% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 131.4 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chilling method.

The experimental method has been described in detail elsewhere (1,2). The melt is saturated with the gas. The dissolved gas is separated from the salt by freezing the melt. The expelled carbon dioxide is measured by transporting it by a stream of pure argon into absorption vessels containing Ascarite/Dehydrite.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.95%) was obtained from Oslo Kulsyrefabrik A/S.

Sodium fluoride was of pro analysi and suprapur grades from E. Merck A. G. It was vacuum dried at 450°C for 12 hrs.

ESTIMATED ERROR:

Presence of oxide impurity in molten NaF may react with CO_2 to form CO_3^{2-}.

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, 19, 13.
2. Ibid. **Acta Chem. Scand.** 1966, 20, 1811.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium fluoride; KF; [7789-23-3]	Bratland, D.; Krohn, C. **Acta Chem. Scand.** 1969, 23, 1839 - 40.
VARIABLES:	**PREPARED BY:**
T/K = 1150 - 1280 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The authors reported the solubilities of CO_2 in the melt in the temperature range 1150 - 1280 K, only in graphical form. The values of Henry's law constants, K_H, extracted from the graph, at different temperatures, are:

T/K	10^6 K_H/mol ml^{-1} atm^{-1}
1154	1.99
1220	2.24
1278	2.72

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -4.334 - 1585/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 2.1\% \quad \text{(compiler)}$$

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = 30.3 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chilling method.

The experimental method has been described in detail elsewhere (1,2). The melt is saturated with the gas. The dissolved gas is separated from the salt by freezing the melt. The expelled carbon dioxide is measured by transporting it by a stream of pure argon into absorption vessels containing Ascarite/Dehydrite.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.95%) was obtained from Oslo Kulsyrefabrik A/S.

Potassium fluoride was of reagent grade from Baker and Adamson.

ESTIMATED ERROR:

Presence of oxide impurity in molten KF may react with CO_2 to form CO_3^{2-}.

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, 19, 13.
2. Ibid. **Acta Chem. Scand.** 1966, 20, 1811.

COMPONENTS:	EVALUATOR:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium bromide; KBr; [7758-02-3]	N. P. Bansal National Aeronautics and Space Research. Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Two independent studies (1,2) are available for the solubility of carbon dioxide in molten KBr. Smoothed data at different temperatures from the two investigations are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}	
T/K	Sada et al. (1)	Bratland et al. (2)
1100	(10.59)	9.12
1120	(10.48)	9.43
1140	10.37	9.73
1160	10.27	10.03
1180	10.17	10.33
1200	10.08	10.63
1220	9.99	(10.93)

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

The results of the two studies are not in good agreement with each other. Bratland et al. (2) report a positive value of ΔH while the data of Sada et al. (1) suggest a negative value.

Further work needs to be done in order to advance recommended values of solubility for this gas - molten salt system.

References:

1. Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N. **J. Chem. Eng. Data** 1981, 26, 279.

2. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **Acta Chem. Scand.** 1966, **20**, 1811; **J. Metals** 1967, **19**, 13.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium bromide; KBr; [7758-02-3]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data 1981, 26, 279 - 81.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 1123 - 1223

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at one atmosphere pressure are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
850	1.02
900	1.08
950	0.97

Smoothed Data:

Temperature dependence of K_H is expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -6.236 + 287.2/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 3\% \quad \text{(compiler)}$$

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -5.5 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was determined with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Potassium bromide was of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium bromide; KBr; [7758-02-3]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

Acta Chem. Scand. 1966, 20, 1811 - 26.

VARIABLES:

T/K = 1048 - 1200
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Gas solubilities at different temperatures at 1 atm pressure are:

t/°C	10^7 K_H/mol ml^{-1} atm^{-1}
775	8.46 ± 0.14
829	9.36 ± 0.13
874	9.80 ± 0.20
927	10.89 ± 0.14

Smoothed Data:

Temperature dependence of the Henry's law constant, K_H, is given by the equation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -5.24 - 880/(T/K)$$

std. dev. = 0.7% (compiler)

The heat of dissolution, ΔH, and the entropy of dissolution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 16.7$$

$$\Delta S/\text{J K}^{-1}\ \text{mol}^{-1} = 14.6$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Chilling method.

Detailed description and diagram of the apparatus is given in the original paper. It employs the separation of dissolved gas from the salt by freezing of the melt. The expelled carbon dioxide is carried into the absorption vessel by a stream of pure nitrogen.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide - not given.

Potassium bromide was of pro analysi grade from E. Merck A. G. The salt was dried under vacuum at 450°C for 4 hours.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium bromide; KBr; [7758-02-3]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

J. Metals 1967, **19**, 13 - 20.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 1048 - 1200

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 in molten KBr are presented in the form of a log K_H vs. 1/T plot. Values of K_H derived from the graph, by the compiler, at various temperatures are given below:

T/K	10^7 K_H/mol ml^{-1} atm^{-1}
1048	8.5 ± 0.15
1103	9.4 ± 0.20
1145	9.8 ± 0.20
1199	10.9 ± 0.20

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -5.24 - 872.4/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.7\% \quad \text{(compiler)}$$

The heat of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 17.15$$

$$\Delta S/\text{J K}^{-1}\ \text{mol}^{-1} = 15.06 \quad \text{(at 1150 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Detailed descriptions of the apparatus and procedure for each method are given in the original paper.

Volumetric Method: The change in volume of gas (at constant pressuure) caused by its dissolution in the melt is directly determined. This is not an accurate method, the estimated uncertainty being about 25%.

Thermogravimetric Method: The gain in weight of a melt sample due to the dissolution of the gas is measured using a thermobalance.

Chilling Method: The dissolved gas is separated from the melt by freezing of the melt. The expelled gas is carried into absorption vessels containing Ascarite/Dehydrite expelled gas is carried into absorption vessels containing by a stream of pure argon. This method is simpler and more expedient than the others but giving comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

Potassium bromide, pro analysi quality, from Merck AG, Darmstadt, West Germany was used. It was either dried in situ (volumetric and thermogravimetric methods) or pre-dried in vacuum at 450°C for 4 hrs. (chilling method).

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Zinc bromide; $ZnBr_2$; [7699-45-8]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45 - 47.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 673 - 748

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at a pressure of 1 atm are given as:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
400	2.19
450	1.80
475	1.78

Smoothed Data:

Temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.616 + 641.07/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.8% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -12.3 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

Diagram and details of the solubility apparatus are described in the original publication. The melt was saturated with CO_2 by bubbling the gas through the melt for 50 min. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted mixture was determined with an infrared carbon dioxide analyzer (Shimadzu, Type URA-25.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was superpure grade and free from water.

Zinc bromide was reagent grade. It was dried in a desiccator for a few days followed by in a vaccum oven at 150 - 200°C for several hours. It was further dried by bubbling anhydrous nitrogen through the salt in the molten state.

ESTIMATED ERROR:

std. error in solubility: < ± 10%

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2;
[124-38-9]

(2) Potassium iodide; KI;
[7681-11-0]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.;
Krohn, C.; Matzfeldt, K.

J. Metals 1967, **19**, 13 - 20.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of CO_2 in molten KI in a very narrow temperature range is presented in the form of a log K_H vs. 1/T plot. The value of K_H derived from the graph, by the compiler, is given below:

T/K	10^7 K_H/mol ml^{-1} atm^{-1}
973	19.4 ± 0.6

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Detailed descriptions of the apparatus and procedure for each method are given in the original paper.
Volumetric Method: The change in volume of gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not an accurate method, uncertainty being about 25%.
Thermogravimetric Method: The gain in weight of a melt sample due to the dissolution of the gas is measured by a thermobalance.
Chilling Method: The dissolved gas is removed from the melt by freezing the melt. The expelled gas is carried into absorption vessels containing Ascarite/ Dehydrite by a stream of pure argon. This method is simpler and more expedient than the others while giving comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

Potassium iodide, *pro analysi* quality, from Merck AG, Darmstadt, West Germany was used. It was either dried *in situ* (volumetric and thermogravimetric methods) or pre-dried in vacuum at 450°C for 4 hrs. (chilling method).

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Potassium iodide; KI; [7681-11-0]

ORIGINAL MEASUREMENTS:

Bratland, K.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

Acta Chem. Scand. 1966, 20, 1811 - 26.

VARIABLES:

P/kPa: 101.325 (1 atm.)

T/K = 954 & 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 in molten KI at 1 atm. pressure at two temperatures are:

t/°C	10^7 K_H/mol ml^{-1} atm^{-1}
681	9.8 ± 0.6[a]
700	19.2 ± 0.6[b]

[a] By volumetric method

[b] By chilling method

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Two different techniques have been used: volumetric and chilling method. A detailed description of each technique is given in the original publication. Volumetric Method: The change in volume of the gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not a very accurate method and was finally abandoned. The established uncertainty in the results was about 25%. Chilling Method: It employs the separation of the dissolved gas from the salt by freezing the melt. The expelled carbon dioxide is carried into the absorption vessel by a stream of pure nitrogen. This a less cumbersome and more expedient method than the other but the accuracy of the results is better.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide - not given. Potassium iodide was of pro analysi grade from E. Merck A. G. In the volumetric and thermogravimetric measurements, the salt was dried in situ, whereas in the chilling method, the salt was dried under vacuum at 450°C for 4 hrs.

ESTIMATED ERROR:

solubilty = ± 10%

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]

(2) Sodium carbonate; Na_2CO_3; [497-19-8]

ORIGINAL MEASUREMENTS:

Andresen, R. E.

J. Electrochem. Soc. 1979, 126, 328 - 34.

VARIABLES: P/kPa = 39.997 - 101.325

one temperature: T/K = 1153

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of CO_2 in molten Na_2CO_3, the value of Henry's law constant, K_H, is:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
880	9.6 ± 2.3[a]

[a] Value not corrected for the effect of the reaction:

$$Na_2CO_3 \rightleftarrows Na_2O + CO_2(g)$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The diagram and details of the apparatus used are given in the original paper. The procedure followed has been described in detail elsewhere (1). In brief, the apparatus was first evacuated and then filled with CO_2 to a pressure of about 1 atm. Due to gas dissolution, the gas pressure dropped. Equilibrium was attained when the pressure did not change for about 1 hr. The volume of the gas dissolved was determined from the initial and final positions of the mercury meniscus in the manometer. The apparatus was earlier calibrated using argon. With a cathetometer, pressure changes as small as 0.05 torr could be read.

SOURCE AND PURITY OF MATERIALS:

CO_2 (99.6%) was used directly from the cylinder.

Reagent grade Na_2CO_3 supplied by Baker was dried at about 445 K in an oven, then in the furnace at about 645 K under CO_2 pressure of 100 torr for about a day.

ESTIMATED ERROR:

solubility = ± 30%

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A. **Proceedings of the 4th Nordic High Temperature Symposium, Vol. 1, (Tilbi, M.; Editor), Helsinki** 1975, 127.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data 1981, **26**, 279 - 81.

VARIABLES:

one temperature: T/K = 623
melt comp./mol% $NaNO_3$ = 0 - 100
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 at one atmosphere pressure and 623K in $LiNO_3$ - $NaNO_3$ melts of different compositions are:

Melt composition/ mol fraction of $NaNO_3$	10^6 C_1/ mol cm^{-3}	10^4 x_1/ mol fraction
0.0	3.86	1.54
0.07	4.70	1.89
0.20	3.68	1.52
0.25	4.67	1.93
0.50	2.79	1.19
0.52	3.18	1.37
0.66	2.34	1.03
1.00	1.04	0.468

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of CO_2 in the eluted mixture was determined with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Sodium nitrate and lithium nitrate were of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

   J. Chem. Eng. Data 1980, **25**, 45.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, **69**, 2019 - 25.

VARIABLES:

$P/kPa = 10^2$
$T/K = 473 - 540$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, x_1, of CO_2 in molten mixtures of $LiNO_3$ - KNO_3 (50 - 50, 66.67 - 33.33 mol%) at different temperatures are reported in graphical form in the original paper. The values of x_1, derived from the graph by the compiler, are:

Melt composition/ mol% $LiNO_3$	T/K	10^5 x_1/ mol fraction bar^{-1}
50.0	474	5.62
	499	5.55
	529	5.29
66.67	478	10.03
	486	8.96
	488	8.96
	494	9.41
	503	9.07
	512	9.07
	513	9.76
	517	8.42
	528	8.42
	539	8.63

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The experimental procedure has been described in detail elsewhere (1,2). In brief, the apparatus was evacuated and then carbon dioxide was introduced into the system at about one bar pressure. The initial gas pressure was immediately noted. The melt was vigorously stirred and the fall in gas pressure due to its dissolution in the melt was continuously recorded till equilibrium was reached. The final gas pressure was noted and the Henry's constant was calculated.

SOURCE AND PURITY OF MATERIALS:

High purity quality carbon dioxide (S.I.O., Milan) was dried in dry ice.

Reagent grade lithium and potassium nitrates (Carlo Erba, Milan) were used without further purification.

The melt container was made of Teflon.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Electroanal. Chem.** 1972, **38**, 373.
2. Zambonin, P. G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** 1970, **28**, 237.

COMPONENTS: (1) Carbon dioxide; CO_2; [124-38-9] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	**ORIGINAL MEASUREMENTS:** Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, **69**, 2019 - 25.
VARIABLES:	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

Temperature dependence of x_1 could be expressed by equations of the form:

$$\log(x_1/\text{mol fraction bar}^{-1}) = a + b/(T/K)$$

The values of the coefficients a and b of the above equation for the two molten mixtures, alongwith the enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

Melt composition/ mol% $LiNO_3$	a	b	ΔH/ kJ mol^{-1}	$\Delta S°^a$/ J K^{-1} mol^{-1}
50.0	-4.502	120.5	-3.0	-30.0
66.67	-4.446	203.06	-5.5	-30.0

[a] At 623 K

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	**SOURCE AND PURITY OF MATERIALS:**
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, 69, 2019 - 25.
VARIABLES: $P/kPa = 10^2$ $T/K = 510 - 610$	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities, x_1, of CO_2 in the molten equimolar mixture $NaNO_3$ - KNO_3 are reported in graphical form in the original paper. The values of x_1 at different temperatures, derived from the graph by the compiler, are:

Melt composition/ mol% $NaNO_3$	T/K	10^5 x_1/ mol fraction bar^{-1}
50.0	510	2.30
	520	2.42
	529	2.48
	540	2.51
	563	2.54
	586	2.57
	609	2.70

Smoothed Data:

Temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction bar}^{-1}) = -4.284 - 174.5/(T/K) \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$\Delta H/kJ\ mol^{-1} = 3.0$ $\Delta S/J\ K^{-1}\ mol^{-1} = -26.0$ (at 623 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The experimental details are given elsewhere (1,2). Briefly, the apparatus was evacuated and carbon dioxide was introduced into the system at about one bar pressure. The initial gas pressure was immediately recorded. The melt was vigorously stirred and the fall in gas pressure due to its dissolution in the melt was continuously recorded till equilibrium was attained. The final gas pressure was noted and the Henry's constant was evaluated.

SOURCE AND PURITY OF MATERIALS:

High purity quality carbon dioxide (S.I.O., Milan) was dried in dry ice.

Reagent grade sodium and potassium nitrates (Carlo Erba, Milan) were used without further purification.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G. **J. Electroanal. Chem.** 1972, 38, 373.
2. Zambonin, P. G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** 1970, 28, 237.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Rubidium nitrate; $RbNO_3$; [13126-12-0]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data 1981, 26, 279 - 81.

VARIABLES:

one temperature: T/K = 623
melt comp./mol% $NaNO_3$ = 0 - 100
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 at one atmosphere pressure and 623K in $NaNO_3$ - $RbNO_3$ melts of different compositions are:

Melt composition/ mol fraction of $NaNO_3$	10^6 C_1/ mol cm^{-3}	10^5 x_1/ mol fraction
0.0	1.88	11.30
0.25	1.36	7.66
0.50	1.18	6.15
0.75	1.07	5.27
1.00	1.04	4.68

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted gas mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Sodium nitrate and rubidium nitrate were of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

   J. Chem. Eng. Data 1980, 25, 45.

COMPONENTS:

(1) Carbon dioxide; CO_2;
[124-38-9]
(2) Sodium fluoride; NaF;
[7681-49-4]
(3) Beryllium fluoride; BeF_2;
[7789-49-7]

ORIGINAL MEASUREMENTS:

Smith, N. V.; Sheil, R. J.;
Evans, R. B.; Watson, G. M.

U.S.A.E.C. Rept. ORNL-2931 1960,
35 - 36.

VARIABLES:

T/K = 688 - 1073
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of carbon dioxide in the melt NaF - BeF_2 (54 - 43 mol%) as a solvent at different temperatures are given in graphical form. The values extracted from the graph, by the compiler, are:

t/°C	10^8 K_H/mol cm^{-3} atm^{-1}
415	10.35
500	7.93
600	7.05
700	8.32
800	10.78

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.
Details not given.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Yasuda, K.

J. Chem. Eng. Data 1980, 25,

VARIABLES:

T/K = 723 - 803
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in the molten eutectic LiCl - KCl (58 - 48 mol%) are given as:

t/°C	$10^6\ K_H$/mol cm^{-3} atm^{-1}
450	2.4
530	3.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus and procedure used are given in the original paper. The melt was saturated with carbon dioxide by bubbling the gas through the melt. Dissolved carbon dioxide was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted gas mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Lithium chloride and potassium chloride were of reagent grade and were dried in a desiccator for a few days followed by in a vacuum oven at 150 - 200°C for several hours.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Sada, E.; Katoh, S.; Yoshii, H.; Takemoto, I.; Shiomi, N.

J. Chem. Eng. Data 1981, 26, 279 - 81.

VARIABLES:

one temperature: T/K = 1273
melt comp./mol% NaCl = 0 - 100
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The gas solubilities at one atmosphere pressure and 1000°C in NaCl - KCl melts of different compositions are:

Melt Composition/ mol fraction of NaCl	$10^7 C_1$/ mol cm^{-3}	$10^5 x_1$/ mol fraction
0.0	9.08	4.85
0.25	7.24	3.65
0.50	8.17	3.86
0.75	9.66	4.23
1.00	10.1	4.07

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The apparatus and procedure used for solubility measurements was the same as described in (1). The melt was saturated with carbon dioxide by bubbling the gas through the melt. Carbon dioxide dissolved in the melt was eluted by bubbling nitrogen. The amount of carbon dioxide in the eluted gas mixture was measured with an infrared carbon dioxide analyzer.

SOURCE AND PURITY OF MATERIALS:

Carbon dioxide (99.96%) was of superpure grade and free from water.

Sodium chloride and potassium chloride were of reagent grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Sada, E.; Katoh, S.; Beniko, H.; Yoshii, H.; Kayano, M.

J. Chem. Eng. Data 1980, 25, 45.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Potassium chloride; KCl; [7447-40-7]
(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vil'nyanskii, Ya. E.

Izv. Vyssh. Uchebn. Zaved., Khim. i Khim. Tekhnol. 1966, 9, 537 - 540.

VARIABLES:

T/K = 773 - 1173
P/kPa = 30.398 - 103.352

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of CO_2 in molten equimolar KCl - $MgCl_2$ at different temperatures as a function of its partial pressure are reported as:

		Solubility of CO_2		
t/°C	P_{CO_2}/atm	x_1/mol fraction	10^4 C_1/ wt%	x_1/mol fraction atm^{-1}
500	0.33	2.51	130	6.22
	0.49	3.30	171	5.66
	0.78	5.11	268	6.37
	1.02	6.19	322	6.01
650	0.32	3.65	190	9.58
	0.45	4.56	237	8.84
	0.76	7.51	389	9.22
	1.01	9.38	489	9.35
750	0.34	5.26	271	12.32
	0.48	7.12	371	12.56
	0.77	10.28	532	12.50
	1.00	12.74	650	12.74

cont'd.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method. The apparatus and the method used for gas solubility measurements have been described earlier (1). Dry CO_2 gas was passed through about 100 g of the melt at a rate of 10 l/hr. After saturation, a portion of the melt was transferred into the desorber and flushed with nitrogen. The nitrogen from the desorber was passed through the absorbent and the amount of liberated CO_2 was determined by weighing.

SOURCE AND PURITY OF MATERIALS:

The method of preparation of the anhydrous melt from carnallite has been described earlier (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Lukmanova, T. L.; Vil'nyanskii, Ya. E.

   Izv. Vyssh. Uchebn. Zaved., Khim. i Khim. Tekhnol. 1964, 7, 510.

COMPONENTS: (1) Carbon dioxide; CO_2; [124-38-9] (2) Potassium chloride; KCl; [7447-40-7] (3) Magnesium chloride; $MgCl_2$; [7786-30-3]	ORIGINAL MEASUREMENTS: Lukmanova, T. L.; Vil'nyanskii, Ya. E. **Izv. Vyssh. Uchebn. Zaved., Khim. i Khim. Tekhnol.** 1966, 9, 537 - 540.
VARIABLES: T/K = 773 - 1173 P/kPa = 30.398 - 103.352	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES: continued

850	0.34	6.88	376	13.18
	0.48	7.86	409	12.91
	0.74	10.69	554	13.28
	1.01	13.45	699	13.33
900	0.30	7.77	401	13.29
	0.47	9.41	469	13.19
	0.78	12.43	648	13.30
	1.00	13.90	740	13.90

Smoothed Data:

Temperature dependence of x_1 in the range 773 - 1173 K, can be expressed by the equation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -2.168 - 795.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 3% (compiler)

The heat of solution, ΔH, was calculated to be:

$$\Delta H/\text{kJ mol}^{-1} = 15.2 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Carbon dioxide; CO_2;[124-38-9]
(2) Calcium oxide; CaO;[1305-78-8]
(2) Calcium chloride; $CaCl_2$;
[10043-52-4]

ORIGINAL MEASUREMENTS:

Maeda, M.; McLean, A.
Iron Steelmaker 1986, 13, 61 - 65;
Trans. Iron Steel Soc., ASME 1987,
8, 23 - 27.

VARIABLES:

T/K = 1173 - 1473
Melt comp./mol fraction of CaO
= 0.06 - 0.20

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

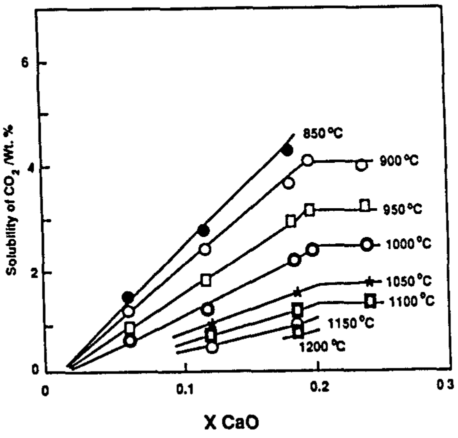


Fig. Solubility of Carbon dioxide as a function of initial mole fraction of CaO in the melt at various temperatures; $p_{CO_2} = 0.2$

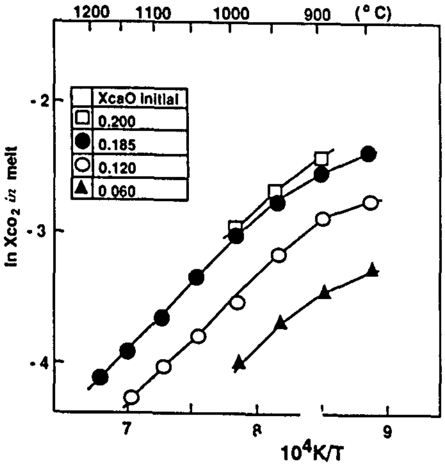


Fig. Temperature dependence of the solubility of CO_2 in melts of different compositions; $p_{CO_2} = 0.2$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gravimetric method.

The slag mixture was contained in a pure nickel combustion boat and placed inside a mullite reation tube. CO(p_{CO} = 0.02) was added to the CO_2 - Ar gas mixture to avoid oxidation of the nickel crucible. The gas mixture was passed over the melt at a rate of 60ml/min. After various time intervals, the melt was quenched and the weight change was recorded. Equilibrium was reached between the gas and the melt within 1hr. The equilibrium concentration of CO_2 was obtained from the difference in the absorption and desorption results.

Experiment was repeated 4 - 5 times.

SOURCE AND PURITY OF MATERIALS:

Calcium carbonate and cacium chloride, both of reagent grade (99.9% purity) were vacuum dried for 12h at 120°C.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Carbon Dioxide; CO_2;[124-38-9]
(2) Calcium Oxide; CaO;[1305-78-8]
(3) Calcium Chloride; $CaCl_2$; [10043-52-4]

ORIGINAL MEASUREMENTS:

Iwase, M.; Iritani, H; Ichise, E.; Shibata, K.
Iron Steel Maker 1989, **16**, 67 - 71.

VARIABLES:

$T/K = 1173 - 1673$
$P/kPa = 25.331 - 101.325$
X_{CaO} /mole fraction = 6 -20

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of CO_2 in the CaO+$CaCl_2$ melts can be represented by the expression :

$$\log \frac{X_{CO_2}(1 + R)}{R - (2R + 1) X_{CO_2}} = \log p_{CO_2} - (6.04 \pm 0.21) + \frac{(7630 \pm 270)}{T}$$

$$\text{where } X_{CO_2} = \frac{n_{CO_2}}{n_{CO_2} + n_{CaO} + n_{CaCl_2}}$$

n denotes the number of moles of each species,

$$R = \frac{X_{CaO}}{X_{CaCl_2}}$$

The correlation coefficient of fitting, r^2, was 0.905.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the experimental apparatus consisting of a thermobalance, an SiC resistance furnace and the gas trains and the procedure have been described earlier(1).

A crucible containing 2-4g of the slag was suspended from the thermobalance and the weight change monitored with time. Temperature was controlled to ±1K. The slag was heated in a stream of purified Ar(200 - 300 ml/min). When the desired temperature was reached, the gas flow was changed to a (Ar+CO_2) gas mixture. In most cases, the dissolution of CO_2 was completed in 15 - 25 min. A longer time was needed for desorption of CO_2 in Ar.

Reproducibility of the measurements was checked by thermal cycling.

SOURCE AND PURITY OF MATERIALS:

Argon was purified by passing through silica gel, P_2O_5, sodium oxyhydrate, $MgClO_4$, and Mg chips (723K). (Ar+CO_2) gas mixture was purified over silica gel, $MgClO_4$ and P_2O_5.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Iwase, M. et al.
Iron Steel Maker 1987, **15**, 77;
Trans. Iron Steel Soc. 1988, **9**, 139.

COMPONENTS:

(1) Carbon Dioxide; CO_2;[124-38-9]
(2) Strontium Oxide; SrO;[1314-11-0]
(3) Strontium Chloride; $SrCl_2$;
[10476-85-4]

ORIGINAL MEASUREMENTS:

Iwase, M.; Iritani, H; Ichise, E.;
Shibata, K.
Iron Steel Maker 1989, 16, 67 - 71.

VARIABLES:

$T/K = 1173 - 1673$
$P/kPa = 25.331 - 101.325$
X_{CaO} /mole fraction = 10 - 50

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of CO_2 in the SrO+$SrCl_2$ melts can be expressed by the relation :

$$\log \frac{X_{CO_2}(1 + R)}{R - (2R + 1)\, X_{CO_2}} = \log p_{CO_2} - (5.60 \pm 0.17) + \frac{(8650 \pm 260)}{T}$$

where $R = X_{SrO}/X_{SrCl_2}$

$$X_{CO_2} = n_{CO_2} \;/\; (\, n_{CO_2} + n_{SrO} + n_{SrCl_2})$$

where n denotes the number of moles of each species.

The correlation coefficient of fitting, r^2, was 0.926.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the experimental apparatus consisting of a thermobalance, an SiC resistance furnace and the gas trains and the procedure have been described earlier(1).

A crucible containing 2-4g of the slag was suspended from the thermobalance and the weight change monitored with time. Temperature was controlled to ±1K. The slag was heated in a stream of purified Ar(200 - 300 ml/min). When the desired temperature was reached, the gas flow was changed to a (Ar+CO_2) gas mixture. In most cases, the dissolution of CO_2 was completed in 15 - 25 min. A longer time was needed for desorption of CO_2 in Ar.

Reproducibility of the measurements was checked by thermal cycling.

SOURCE AND PURITY OF MATERIALS:

Argon was purified by passing through silica gel, P_2O_5, sodium oxyhydrate, $MgClO_4$, and Mg chips (723K). (Ar+CO_2) gas mixture was purified over silica gel, $MgClO_4$ and P_2O_5.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1.Iwase, M. et al.
Iron Steel Maker 1987, 15, 77;
Trans. Iron Steel Soc. 1988, 9, 139.

COMPONENTS:

(1) Carbon Dioxide; CO_2;[124-38-9]
(2) Barium Oxide; BaO;[1304-28-5]
(3) Barium Chloride; $BaCl_2$;
[10361-37-2]

ORIGINAL MEASUREMENTS:

Iwase, M.; Iritani, H; Ichise, E.;
Shibata, K.
Iron Steel Maker 1989, 16, 67 - 71.

VARIABLES:

$T/K = 1173 - 1673$
$P/kPa = 25.331 - 101.325$
X_{BaO} /mole fraction = 10 - 40

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of CO_2 in the BaO+$BaCl_2$ melts can be expressed by the relation :

$$\log \frac{X_{CO_2}(1 + R)}{R - (2R + 1)\, X_{CO_2}} = \log p_{CO_2} - (4.55 \pm 1.72) + \frac{(7240 \pm 270)}{T}$$

where $R = X_{BaO}/X_{BaCl_2}$

$$X_{CO_2} = n_{CO_2} / (n_{CO_2} + n_{BaO} + n_{BaCl_2})$$

where n denotes the number of moles of each species.

The correlation coefficient of fitting, r^2, was 0.805.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The details of the experimental apparatus consisting of a thermobalance, an SiC resistance furnace and the gas trains and the procedure have been described earlier(1).

A crucible containing 2-4g of the slag was suspended from the thermobalance and the weight change monitored with time. Temperature was controlled to ±1K. The slag was heated in a stream of purified Ar(200 - 300 ml/min). When the desired temperature was reached, the gas flow was changed to a (Ar+CO_2) gas mixture. In most cases, the dissolution of CO_2 was completed in 15 - 25 min. A longer time was needed for desorption of CO_2 in Ar.

Reproducibility of the measurements was checked by thermal cycling.

SOURCE AND PURITY OF MATERIALS:

Argon was purified by passing through silica gel, P_2O_5, sodium oxyhydrate, $MgClO_4$ and Mg chips(723K). Ar+CO_2 gas mixture was purified over silica gel, $MgClO_4$ and P_2O_5. BaO powder (99.9% purity, Furu-Uchi Chemical Co.) was heated at 1573K until the weight was unchanged.$BaCl_2$ (99.9% purity, Nakarai Chemical Co. Japan) was mixed with BaO and heated for 10 - 15min. at 1573K and cooled on a water cooled copper plate.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1.Iwase, M. et al.
Iron Steel Maker 1987, 15, 77;
Trans. Iron Steel Soc. 1988, 9, 139.

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Cryolite; Na_3AlF_6; [15096-52-3]
(3) Alumina; Al_2O_3; [1344-28-1]

ORIGINAL MEASUREMENTS:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, **19**, 13 - 20.
2. Bratland, D.; Krohn, C. **Tidsskr. Kjemi, Bergv., Metall.** 1966, **26**, 81 - 4.

VARIABLES:

$T/K = 1250 - 1380$
melt comp./mol% Al_2O_3 = 5 - 17.9
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of CO_2 at 1030°C in Na_3AlF_6 - Al_2O_3 melts of different compositions are presented in the form of log K_H vs. mol% Al_2O_3 graph. Values of K_H derived from the plot at different melt compositions are given below:

t/°C	melt comp. mol% Al_2O_3	10^6 K_H/mol ml^{-1} atm^{-1}
1030	5.0	0.85 ± 0.08
1030	10.0	1.16 ± 0.07
1030	14.0	2.03 ± 0.21
1030	17.9	2.96 ± 0.14

Solubilities of CO_2 in cryolite - alumina (90 - 10 mol%) melts were also measured at 1030°C after the addition of various concentrations of NaF, CaF_2 and AlF_3 to the melt. These results are presented in graphical form. Values of K_H derived from this plot, by the compiler, under different experimental conditions are given below:

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Three techniques have been employed. Detailed description of the apparatus and procedure for each method are given in the original paper.

Volumetric Method: The change in volume of gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not an accurate method, the estimated uncertainty being about 25%.

Thermogravimetric Method: The gain in weight of a melt sample due to the dissolution of the gas is measured using a thermobalance.

Chilling Method: The dissolved gas is removed from the melt by freezing the melt. The expelled gas is carried into absorption vessels containing Ascarite/ Dehydrite by a stream of pure

continued

SOURCE AND PURITY OF MATERIALS:

Sodium fluoride and alumina were of pro analysi quality from Merck AG, Darmstadt, West Germany. Sublimed aluminum fluoride, purity > 99%, was used.

The salts were either dried in situ or pre-dried in vacuum for 4 hrs. at 450°C.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Cryolite; Na_3AlF_6; [15096-52-3] (3) Alumina; Al_2O_3; [1344-28-1]	1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, 19, 13 - 20. 2. Bratland, D.; Krohn, C. **Tidsskr. Kjemi, Bergv., Metall.** 1966, 26, 81 - 4.
VARIABLES: T/K = 1250 - 1380 melt comp./mol% Al_2O_3 = 5 - 17.9 P/kPa: 101.325 (1 atm.)	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued

t/°C	conc. of added salt in the melt/mol%	10^6 K_H/ mol ml^{-1} atm^{-1}
1030	0.0	1.16 ± 0.07
1030	5.0% NaF	1.09 ± 0.09
	7.0% NaF	1.24 ± 0.04
	10.0% NaF	1.30 ± 0.13
1030	5.0% CaF_2	1.25
	7.0% CaF_2	1.43 ± 0.05
	10.0% CaF_2	1.80 ± 0.09
1030	8.5% AlF_3	1.55
	8.85% AlF_3	1.57

The values of Henry's law constant, K_H, for the solubility of CO_2 in molten Na_3AlF_6 - Al_2O_3 (81.4 - 18.6 mol%) have also been reported at different temperatures in graphical form only. The values of K_H, derived from this graph by the compiler are:

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

continued

argon. This method is simpler and more expedient than the others while giving comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Cryolite; Na_3AlF_6; [15096-52-3] (3) Alumina; Al_2O_3; [1344-28-1]	1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K. **J. Metals** 1967, 19, 13 - 20. 2. Bratland, D.; Krohn, C. **Tidsskr. Kjemi, Bergv., Metall.** 1966, 26, 81 - 4.
VARIABLES:	PREPARED BY:
T/K = 1250 - 1380 melt comp./mol% Al_2O_3 = 5 - 17.9 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

continued

T/K	10^6 K_H/mol ml^{-1} atm^{-1}
1252	3.50
1257	3.33
1289	2.98
1328	2.86
1378	2.62

Smoothed Data:

Temperature dependence of K_H may be represented by the relation:

$$\log(K_H/\text{mol ml}^{-1}\text{ atm}^{-1}) = -6.749 + 1600.8/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.4\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -30.6 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Carbon dioxide; CO_2; [124-38-9] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8] (4) Potassium carbonate; K_2CO_3; [584-08-7]	Dubois, P. **Ann. Chem. (Paris)** 1965, 10, 145 - 186.
VARIABLES:	PREPARED BY:
T/K = 833 P/kPa = 1.013 - 101.325	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of CO_2 in the molten eutectic Li_2CO_3 - Na_2CO_3 - K_2CO_3 has been measured at a single temperature. Its value has been reported as:

t/°C	Solubility/ mol $liter^{-1}$ atm^{-1}	Solubility/ g $liter^{-1}$ atm^{-1}
560	0.09 ± 0.01	4.0 ± 0.4

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Thermogravimetric method.

A thermogravimetric technique was used to measure the solubility of CO_2 in molten alkali metal carbonates. The device used allowed a direct reading of the variation of mass of the electrolyte contained in an enclosure, when the atmosphere was changed from one composition to another. The mass was recorded in the absence of any gas flow.

SOURCE AND PURITY OF MATERIALS:

Sodium and potassium carbonates were of *pro analysi* quality from Merck. Lithium carbonate was obtained from Fluka (*purissimum*).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS: (1) Carbon dioxide; CO_2;[124-38-9] (2) Lithium carbonate; Li_2CO_3; [554-13-2] (3) Sodium carbonate; Na_2CO_3; [497-19-8] (4) Potassium carbonate; K_2CO_3; [584-08-7]	**ORIGINAL MEASUREMENTS:** Appleby, A. J.; Van Drunen, C. **J. Electrochem. Soc.** 1980, 127, 1655 - 59.
VARIABLES: T/K = 973 P/kPa: 101.325 (1 atm.)	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of CO_2 in the melt Li_2CO_3 - Na_2CO_3 - K_2CO_3 (43.5 - 31.5 - 25.0 mol%) is reported as:

t/°C	10^3 Solubility/mol dm^{-3} atm^{-1}
700	3.60^a

[a] Mean value of six readings.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: Quenching method. The diagram and details of the apparatus used and procedure followed are described in the original paper. Briefly, the melt was saturated by bubbling the gas for 2 - 3 hr. A portion of the saturated melt was transferred into the chilling compartment where it was slowly quenched to allow all the gases to escape. The liberated gas was flushed with a stream of helium into a U - tube containing activated Linde 5A molecular sieve. The contents of the tube, after being allowed to come to room temperature, were flushed with a stream of carrier gas into a Fisher - Hamilton gas partitioner with Linde 5A column and Katharometer detector for analysis. About 8 - 10 independent measurements were made.	**SOURCE AND PURITY OF MATERIALS:** Not described. **ESTIMATED ERROR:** Nothing specified. **REFERENCES:**

COMPONENTS:

(1) Carbon dioxide; CO_2; [124-38-9]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Aluminum fluoride; AlF_3; [7784-18-1]
(4) Alumina; Al_2O_3; [7344-28-1]

ORIGINAL MEASUREMENTS:

Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfeldt, K.

J. Metals 1967, **19**, 13 - 20.

VARIABLES:

T/K = 1203
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of CO_2 in the molten mixture Li_3AlF_6 - Al_2O_3 (96.9 - 3.1 mol%) at a single temperature is presented in graphical form. Its value derived from the graph, by the compiler, is given below:

t/°C	10^6 Solubility/mol ml^{-1} atm^{-1}
930	2.50 ± 0.15

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Detailed descriptions of the apparatus and procedure for each method are given in the original paper.
Volumetric Method: The change in volume of gas (at constant pressure) caused by its dissolution in the melt is directly determined. This is not an accurate method, the estimated uncertainity being about 25%.
Thermogravimetric Method: The gain in weight of a melt sample due to the dissolution of the gas is using a balance.
Chilling Method: The dissolved gas is removed from the melt by freezing the melt. The expelled gas is carried into absorption vessels containing Ascarite/ Dehydrite by a stream of pure argon. This method is simpler and more expedient than the others while giving comparable or better accuracy.

SOURCE AND PURITY OF MATERIALS:

Lithium fluoride was obtained from the Lithium Corp. of America. Sublimed aluminum fluoride, purity > 99%, was used. Alumina was of *pro analysi* quality from Merck AG, Darmstadt, West Germany.
The salts were either dried *in situ* or pre-dried in vacuum for 4 hrs. at 450°C.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:

(1) Nitrogen dioxide; NO_2; [10102-44-0]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Topol, L. E.; Osteryoung, R. A.; Christie, J. H.

J. Phys. Chem. 1966, 70, 2857 - 62.

VARIABLES:

one temperature: T/K = 573

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of NO_2 in molten equimolar $NaNO_3$ - KNO_3 mixture at 300°C was calculated to be approximately equal to $(5 \pm 3)\ 10^{-6}$ mol cm^{-3}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cyclic voltammetry and chronopotentiometry.

SOURCE AND PURITY OF MATERIALS:

Matheson NO_2 (99.5% pure) was used without further purification.

Sodium and potassium nitrates were dried at 150°C under vacuum.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Sulfur dioxide; SO_2; [7446-09-5]

(2) Sodium sulfate; Na_2SO_4; [7757-82-6]

ORIGINAL MEASUREMENTS:

Andresen, R. E.

J. Electrochem. Soc. 1979, 126, 328 - 34.

VARIABLES:

T/K = 1174 - 1293

P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of SO_2 in molten sodium sulfate, the values of Henry's law constant, K_H, at different temperatures are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
901	0.63
901	0.91
902	1.62
902	1.21
961	1.88
961	2.36
961	2.64
955	3.18
1016	3.06
1018	3.23
1020	3.09

Smoothed Data:

Temperature variation of K_H for the solubility of SO_2 in molten Na_2SO_4 is expressed by the relation:

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The diagram and details of the apparatus used are given in the original paper. The procedure followed has been described in detail elsewhere (1). In brief, the apparatus was first evacuated and then filled with SO_2 to a pressure of about 1 atm. Due to gas dissolution, the gas pressure dropped. Equilibrium was attained when the pressure did not change for about one hour. The volume of the gas dissolved was determined from the initial and final positions of the mercury meniscus in the manometer. The apparatus was earlier calibrated using argon. With a cathetometer, pressure changes as small as 0.05 torr could be read.

SOURCE AND PURITY OF MATERIALS:

SO_2 (99.5%) supplied by Linde Gas Company was used directly from the cylinder using Teflon tubing.

Na_2SO_4, Reagent grade, supplied by Matheson, Coleman and Bell was dried in an oven at about 200°C, then in the furnace at 400°C under vacuum.

ESTIMATED ERROR:

solubility: ± 20 - 30%

REFERENCES:

1. Andresen, R. E.; Paniccia, F.; Zambonin, P. G.; Oye, H. A. **Proceedings of the 4th Nordic High Temperature Symposium, Vol. 1** (Tilli, M.; editor), Helsinki 1975, 127.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Sulfur dioxide; SO_2; [7446-09-5] (2) Sodium sulfate; Na_2SO_4; [7757-82-6]	Andresen, R. E. J. Electrochem. Soc. 1979, 126, 328-34.
VARIABLES:	**PREPARED BY:**
T/K = 1174 - 1293	N. P. Bansal

EXPERIMENTAL VALUES:

continued

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -1.592 - 5003/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 9.5\% \quad \text{(compiler)}$$

The standard enthalpy, $\Delta H°$, and standard entropy, $\Delta S°$, of dissolution are:

$$\Delta H°/\text{kJ mol}^{-1} = 124$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = 113.2 \quad \text{(at 1173 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]

(2) Cesium fluoride; CsF; [13400-13-0]

ORIGINAL MEASUREMENTS:

Winsor, R. V.; Cady, G. H.

J. Amer. Chem. Soc. 1948, 70, 1500 - 02.

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Hydrogen fluoride reacts with cesium fluoride giving rise to formation of four compounds having the compositions: $CsF\cdot HF$, $CsF\cdot 2HF$, $CsF\cdot 3HF$, and $CsF\cdot 6HF$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cooling and warming curves.

The details of the method are given in the original paper.

SOURCE AND PURITY OF MATERIALS:

HF was prepared in the vapor form by distillation of the anhydrous acid from a commercial cylinder.

Cesium fluoride was prepared by reaction between cesium carbonate and aqueous hydrofluoric acid followed by evaporation.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Field, P. E.; Shaffer, J. H.

J. Phys. Chem. 1967, 71, 3218 - 22.

VARIABLES:

T/K = 773 - 973
P/kPa = 101.325 - 202.650

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of HF in molten LiF - BeF_2 (66 - 34 mol%) at different temperatures are:

			10^5 Solubility		10^4 Solubility	
t/°C	saturating press/atm	molar volume of melt/ ml mol^{-1}	mol ml^{-1}	mol ml^{-1} $atm^{-1\,a}$	mol frac	mol frac $atm^{-1\,a}$
500	1.32	16.54	2.68	2.03	4.43	3.36
	1.65		3.40	2.06	5.62	3.41
524	1.99	16.63	3.64	1.83	6.05	3.04
595	1.24	16.89	1.63	1.31	2.75	2.22
600	1.33	16.90	1.72	1.29	2.90	2.18
	1.68		2.06	1.23	3.48	2.07
	1.97		2.40	1.22	4.06	2.06
700	1.61	17.29	1.43	0.89	2.48	1.54
	1.98		1.77	0.89	3.07	1.55

[a] Calculated by the compiler.

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram and details of the apparatus used are given in the original paper. The procedure followed for solubility measurements has been described elsewhere (1). In brief, the melt was saturated with HF at constant pressure by bubbling the gas through it for about 6 hr. A part of the saturated melt was transferred into the stripping section and flushed with helium overnight to liberate the dissolved HF. The HF from the He - HF gas effluent was absorbed in a standard KOH solution and back titrated with a standard HCl solution.

SOURCE AND PURITY OF MATERIALS:

Anhydrous HF (99.9%) supplied by the Matheson Co., East Rutherford, NJ, in a cylinder was used without further purification.

The LiF - BeF_2 (66 - 34 mol%) mixture was prepared by the Oak Ridge National Laboratory. It was treated with a mixture of 10 mol% HF in hydrogen at 600°C and with hydrogen

continued

ESTIMATED ERROR:

solubility = 5% (compiler)

REFERENCES:

1. Shaffer, J. H.; Grimes, W. R. Watson, G. M.

J. Phys. Chem. 1959, 63, 1999.

COMPONENTS:

(1) Hydrogen fluoride; HF;
[7664-39-3]
(2) Lithium fluoride; LiF;
[7789-24-4]
(3) Beryllium fluoride; BeF_2;
[7789-49-7]

ORIGINAL MEASUREMENTS:

Field, P. E.; Shaffer, J, H.

J. Phys. Chem. 1967, 71, 3218 - 22.

VARIABLES:

T/K = 773 - 973
P/kPa = 101.325 - 202.650

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

Values of Henry's law constant and x_1 at various temperatures are:

t/°C	10^5 K_H/mol ml^{-1} atm^{-1} [a]	10^4 x_1/mol fraction atm^{-1}
500	2.04 ± 0.07	3.37 ± 0.13
600	1.28 ± 0.03	2.16 ± 0.05
700	0.87 ± 0.03	1.51 ± 0.06

[a] Calculated by the compiler using molar volume data of melt.

Smoothed Data:

Temperature dependence of Henry's law constant and x_1 is expressed by the relations:

$$\log(K_H/\text{mol ml}^{-1}\ \text{atm}^{-1}) = -6.496 + 1399.3/(T/K) \quad \text{(compiler)}$$

$$\log(x_1/\text{mol fraction atm}^{-1}) = -5.176 + 1319.8/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.3% (compiler)

The enthalpy, ΔH, and entropy, ΔS, of solution are:

ΔH/kcal mol^{-1} = -5.98 ± 0.19 ΔS/cal K^{-1} mol^{-1} = -7.07 ± 0.26 (at 600°C)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

continued

alone at 700°C to remove the oxides, sulfides and other impurities.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Watson, G. M.

U.S.A.E.C. Rept. ORNL-2931 1960, 31 - 32.

VARIABLES:

T/K = 873 - 1073
melt comp./mol% LiF = 54 - 89
P/kPa = 50.663 - 303.975

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Molten salt mixtures of LiF - BeF_2 of different compositions containing 54 - 89 mol% LiF were employed as solvents. The Henry's law constants, K_H, for the solubility of HF in various melts at different temperatures are:

Melt Composition/	10^6 K_H/mol cm^{-3} atm^{-1}		
mol% LiF	600°C	700°C	800°C
54	9.4	7.3	5.6
59	10.9	7.8	6.0
69	13.7	9.8	7.0
80	16.3[a]	11.7	8.8
89	17.3[a]	13.0[a]	10.3[a]

[a] Extrapolated from results at higher temperatures, by the authors.

Smoothed Data:

Temperature dependence of Henry's law constant, K_H, can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = a + b/(T/K)$$

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The procedure followed for determining the solubilities has been described earlier (1). Briefly, the method consisted in saturating the melt with HF at known pressure and temperature. A measured portion of the saturated melt was transferred to the stripping section of the apparatus. The HF dissolved in this melt was stripped by flushing with helium. The amount of HF evolved was determined by absorption in a standard solution of aqueous KOH and back titrating with a standard acid solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Shaffer, J. H.; Grimes, W. R. Watson, G. M.

J. Phys. Chem. 1959, 63, 1999.

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Lithium fluoride; LiF; [7789-24-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Watson, G. M.

U.S.A.E.C. Rept. ORNL-2931 1960, 31 - 32.

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

The values of coefficients, a, and b of the above equation (evaluated by the compiler) for the melts of different compositions along with the heats of solution, ΔH, and entropies of solution, ΔS, are given below:

Melt Composition/ mol% LiF	a	b	ΔH/ kJ mol^{-1}	ΔS^a/ J K^{-1} mol^{-1}
54	-6.224	1049.5	-20.9	-45.2
59	-6.356	1215.9	-23.4	-46.9
69	-6.418	1361.8	-26.8	-48.5
80	-6.222	1253.5	-23.8	-43.9
89	-5.970	1055.2	-20.5	-39.3

[a] Entropies of solution calculated for equal concentrations of HF in gas and solution phases at 1000 K.

std. dev. = 0.007 - 1.3% (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Watson, G. M.

U.S.A.E.C. Rept. ORNL-2931 1960, 31 - 32,

VARIABLES:

T/K = 873 - 1073
melt comp./mol% NaF = 49 - 75
P/kPa = 50.663 - 303.975

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Molten salt mixtures of NaF - BeF_2 of different compositions containing 49 - 75 mol% NaF were employed as solvents. The Henry's law constants, K_H, for the solubility of HF in various melts at different temperatures are:

Melt Composition/	10^6 K_H/mol cm^{-3} atm^{-1}		
mol% NaF	600°C	700°C	800°C
49	18.8	13.1	10.0
58	26.7	18.0	13.9
66	49.2	31.2	21.8
70	107.1	55.2	34.3
75	179.0[a]	93.0[a]	55.1

[a] Values exrapolated from results at higher temperatures, by the authors.

Smoothed Data:

The temperature dependence of Henry's law constant, K_H, can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = a + b/(T/K)$$

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The procedure followed for solubility measurements has been described in detail elsewhere (1). Briefly, the method consisted in saturating the melt with HF at known pressure and temperature. A measured portion of the saturated melt was transferred to the stripping section of the apparatus. The HF dissolved in this melt was stripped by flushing with helium. The amount of HF evolved was determined by absorption in a standard solution of aqueous KOH and back titrating with a standard acid solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

solubility = + 10%

REFERENCES:

1. Shaffer, J. H.; Grimes, W. R.; Watson, G. M.

J. Phys. Chem. 1959, 63, 1999.

COMPONENTS:

(1) Hydrogen fluoride; HF;
[7664-39-3]
(2) Sodium fluoride; NaF; [7681-
[7681-49-4]
(3) Beryllium fluoride; BeF_2;
[7789-49-7]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Watson, G. M.

U.S.A.E.C. Rept. ORNL-2931 <u>1960</u>,
31 - 32.

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

Values of coefficients, a, and b of the above equation (evaluated by the compiler) for the melts of different composition along with the heats of solution, ΔH, and entropies of solution, ΔS, are given below:

Melt Composition/ mol% NaF	a	b	ΔH/ kJ mol^{-1}	ΔS^a/ J K^{-1} mol^{-1}
49	-6.201	1286.5	-22.2	-22.2
58	-6.105	1333.3	-23.0	-20.1
66	-6.207	1657.3	-28.5	-21.8
70	-6.634	2322.0	-40.2	-28.5
75	-6.495	2398.5	-42.3	-26.8

[a] Entropies of solution calculated for equal concentrations of HF in gas and solution phases at 1000 K.

std. dev. = 0.007 - 1.2% (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Grimes, W. R.; Watson, G. M.

J. Phys. Chem. 1959, **63**, 1999 - 2002.

VARIABLES:

P/kPa = 50.663 - 303.975
T/K = 823 - 1073
melt comp./mol% NaF = 45 - 80.5

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of HF in molten NaF - ZrF_4 (53 - 47 mol%) at different temperatures and various saturating pressures are:

t/°C	saturating pressure/atm	10^5 Solubility mol cm^{-3}	10^5 K_H/ mol cm^{-3} atm^{-1}
550	2.09	2.91	1.39
	2.56	3.62	1.41
	2.96	3.98	1.35
			Avg = 1.38 ± 0.02
600	0.494	0.57	1.16
	0.550	0.66	1.19
	0.565	0.69	1.23
	1.05	1.39	1.32
	1.05	1.33	1.27
	1.34	1.62	1.21
	1.50	1.75	1.17
	1.55	1.92	1.24
	2.05	2.72	1.33
	2.05	2.45	1.19
	2.52	3.07	1.22
	2.52	3.02	1.20
	2.53	3.11	1.23
	2.95	3.52	1.20
			Avg = 1.23 ± 0.04

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The details about the apparatus used and the procedure followed for solubility measurements are given in the original publication and also in (1,2). In brief, the melt was saturated by sparging with HF at the desired pressure for 6 hrs. About one - half of the melt was transferred from the saturator to the stripping section by destroying the frozen seal. The dissolved HF in the salt was stripped by bubbling helium and absorbed in a standard aqueous solution of KOH. The amount of absorbed HF was determined by back titration with a standard acid solution.

SOURCE AND PURITY OF MATERIALS:

Hydrogen fluoride (99.9%) from cylinders supplied by Harshaw Chemical Company, Cincinnati was used without further purification. The HF vapors contained less than 0.2 mol% gases insoluble in aqueous KOH.

Sodium fluoride was of reagent grade. ZrF_4 was prepared by

continued

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M. **J. Phys. Chem.** 1958, **62**, 862.
2. Blander, M.; Grimes, W. R.; Smith, N. V. **Ibid.** 1959, **63**, 1164.

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Grimes, W. R.; Watson, G. M.

J. Phys. Chem. 1959, 63, 1999 - 2002.

VARIABLES

P/kPa = 50.663 - 303.975
T/K = 823 - 1073
melt comp./mol% NaF = 45 - 80.5

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: continued

t/°C	saturating pressure/atm	10^5 Solubility mol cm^{-3}	10^5 K_H/ mol cm^{-3} atm^{-1}
650	0.43	0.47	1.10
	1.03	1.02	1.00
	1.47	1.49	1.01
	2.14	2.20	1.03
	2.36	2.41	1.02
	2.74	2.81	1.03
			Avg = 1.03 ± 0.02
700	0.62	0.58	0.93
	1.16	1.08	0.93
	1.40	1.32	0.95
	1.79	1.68	0.94
	1.86	1.80	0.97
	2.75	2.42	0.88
			Avg = 0.93 ± 0.02
750	0.83	0.73	0.88
	1.15	1.00	0.87
	1.96	1.63	0.84
			Avg = 0.86 ± 0.02
800	0.42	0.31	0.74
	0.84	0.62	0.74
	1.51	1.14	0.75
	2.18	1.54	0.73
	2.48	1.75	0.71
			Avg = 0.73 ± 0.01

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

continued

hydrofluorination of $ZrCl_4$ at 450°C in nickel equipment. The solvent mixture was purified as described elsewhere (1).

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Hydrogen fluoride; HF; [7664-39-3]
(2) Sodium fluoride; NaF; [7681-49-4]
(3) Zirconium fluoride; ZrF_4; [7783-64-4]

ORIGINAL MEASUREMENTS:

Shaffer, J. H.; Grimes, W. R.; Watson, G. M.

J. Phys. Chem. 1959, 63, 1999 - 2002.

VARIABLES:

T/K = 823 - 1073
P/kPa = 50.663 - 303.975
Melt comp. NaF/mol% = 45 - 80.5

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

The values of Henry's law constant, K_H, in melts of different compositions are:

Melt Composition/ mol% NaF	10^5 K_H/mol cm^{-3} atm^{-1}					
	550	600	650	700	750	800
45		0.78		0.65		0.51
53	1.38[@]	1.23[#]	1.03[@]	0.93[@]	0.86[@]	0.73["]
60		1.53		1.03		0.81
65		2.17[a]		1.46		1.06
80.5		12.80[a]		7.20[a]		4.43

[@] Value ± 0.02, [#] Value ± 0.04, ["] Value ± 0.01.
[a] Values extrapolated from measurements at higher temperatures, by the authors.

Smoothed Data:

Temperature dependence of the Henry's law constant, K_H, can be expressed by the equation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = a + b/(T/K)$$

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen fluoride; HF; [7664-39-3] (2) Sodium fluoride; NaF; [7681-49-4] (3) Zirconium fluoride; ZrF_4; [7783-64-4]	Shaffer, J. H.; Grimes, W. R.; Watson, G. M. **J. Phys. Chem.** 1959, 63, 1999 - 2002.
VARIABLES:	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued

Values of parameters, a, and b of the above equation (evaluated by the compiler) for various melt compositions along with the enthalpies of solution, ΔH and entropies of solution, ΔS, as calculated by the authors are:

Melt Composition/ mol% NaF	a	b	ΔH/ kcal mol^{-1}	ΔS^a/ eu
45	-6.083	857.5	-3.85	-5.2
53	-6.013	954.4	-4.70	-5.4
60	-6.311	1300.6	-5.80	-6.2
65	-6.334	1458.3	-6.60	-6.4
80.5	-6.363	2158.0	-9.70	-6.5

[a] Entropies of solution calculated for equal concentrations of HF in gas and liquid phases at 1000 K (authors).

std. dev. = 0.05 - 2.5% (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen fluoride; HF; [7664-39-3] (2) Lithium fluoride; LiF; [7789-24-4] (3) Beryllium fluoride; BeF_2; [7789-49-7] (4) Zirconium fluoride; ZrF_4; [7783-64-4] (5) Thorium fluoride; ThF_4; [13709-59-6] (6) Uranium fluoride; UF_4; [10049-14-6]	Shaffer, J. H.; Watson, G. M. U.S.A.E.C. Rept. O.R.N.L.-3127 1960, 13 - 16.
VARIABLES:	**PREPARED BY:**
T/K = 773 - 973 P/kPa = 141.855 - 243.18	N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HF in the molten salt solvent LiF - BeF_2 - ZrF_4 - ThF_4 - UF_4 (65 - 28 - 5 - 1 - 1 mol%) at different temperatures and pressures ranging from 1.4 to 2.4 atm are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}
500	17.0
550	13.3
600	10.8
700	8.0

Smoothed Data:

Temperature dependence of K_H can be expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.365 + 1228.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.9% (compiler)

The enthalpy of solution, ΔH, in the temperature range 500 - 700°C is:

$$\Delta H/\text{kcal mol}^{-1} = -5.65$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Not described.	Not described.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Deuterium fluoride; DF;

(2) Lithium fluoride; LiF;
[7789-24-4]

(3) Beryllium fluoride; BeF_2;
[7789-49-7]

ORIGINAL MEASUREMENTS:

Field, P. E.; Shaffer, J. H.

J. Phys. Chem. 1967, 71, 3218 - 22.

VARIABLES:

P/kPa = 101.325 - 202.650
T/K = 773 - 973

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of DF in molten LiF - BeF_2 (66 - 34 mol%) at different temperatures are:

t/°C	saturating pressure/atm	molar volume of melt/ml mol^{-1}	10^5 solubility/ mol ml^{-1}	10^4 solubility mol fraction
500	1.24	16.54	2.21	3.66
	1.62		2.88	4.76
	1.93		3.52	5.81
600	1.27	16.90	1.37	2.32
	1.61		1.70	2.87
	1.96		2.13	3.60
700	1.70	17.29	1.25	2.15
	1.99		1.48	2.54

continued.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The diagram of the apparatus used has been given in the original paper. The procedure followed for solubility measurements has been described elsewhere(1). In brief, the melt was saturated with DF by bubbling the gas, at constant temperature, through it for about 6hrs. A part of the saturated melt was transferred into the stripping section and flushed with helium overnight to remove the dissolved effluent was absorbed in a standard KOH solution and back titrated with a standard HCl solution.

SOURCE AND PURITY OF MATERIALS:

Anhydrous DF was prepared by the Technical Division, Oak Ridge Gaseous Diffusion Plant, by reaction of elemental deuterium and fluorine.

The LiF - BeF_2(66-34 mol%) mixture was prepared by the Oak Ridge National Laboratory. It was treated with a mixture of 10 mol% HF in H_2 at 600°C and with H_2 alone at 700°C to remove the oxides, sulfides and other impurities.

ESTIMATED ERROR:

Solubility = ± 5% (authors)

REFERENCES:

1. Shaffer, J. H.; Grimes, W. R.; Watson, G. M.
J. Phys. Chem. 1959, 63, 1999.

COMPONENTS:

(1) Deuterium fluoride; DF;

(2) Lithium fluoride; LiF; [7789-24-4]

(3) Beryllium fluoride; BeF_2; [7789-49-7]

ORIGINAL MEASUREMENTS:

Field, P. E.; Shaffer, J. H.

J. Phys. Chem. 1967, 71, 3218 - 22.

VARIABLES:

T/K = 773 - 973

P/kPa = 101.325 - 202.650

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

(Continued)

The values of Henry's law constant and solubility at various temperatures are:

t/°C	10^5 K_H/mol cm^{-3} atm^{-1}[a]	10^4 x_1/mol fraction atm^{-1}
500	1.79 ± 0.04	2.96 ± 0.07
600	1.08 ± 0.02	1.83 ± 0.03
700	0.72 ± 0.02	1.25 ± 0.03

Smoothed Data:

Temperature dependence of Henry's law constant and solubility is expressed by the relations:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -6.671 + 1487.8/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.08\% \quad \text{(compiler)}$$

$$\log(x_1/\text{mol fraction atm}^{-1}) = -5.35 + 1405.8/(T/K) \quad \text{(compiler)}$$

The enthalpy, ΔH, and entropy, ΔS, of solution are:

$$\Delta H/\text{kcal mol}^{-1} = -6.43 + 0.11$$

$$\Delta S/\text{cal K}^{-1}\text{ mol}^{-1} = -7.92 + 0.16 \quad \text{(at 600°C)}$$

[a] Calculated by the compiler using molar volume data of melt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Lithium chloride; LiCl; [7447-41-8]

ORIGINAL MEASUREMENTS:

Ukshe, E. A., Devyatkin, V. N.

Zh. Fiz. Khim. 1965, 39, 2288 - 90; Russ. J. Phys. Chem. (Eng. Transl.) 1965, 39, 1222 - 23. (*).

VARIABLES: P/kPa: 101.325 (1 atm.)

T/K = 973 - 1073

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, at one atmosphere gas pressure, in molten LiCl at different temperatures are:

t/°C	$10^6\ x_1$/(mol fraction) atm^{-1}
700	9.86
750	14.72
800	20.33

Smoothed Data:

Temperature dependence of x_1, in the range 700 - 800°C, is given by the expression:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -1.6276 - 3285.4/(T/K)$$ (compiler)

std. dev. = 0.8% (compiler)

The heat of solution, ΔH, is given by:

$$\Delta H/\text{kJ mol}^{-1} = +\ 57.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping technique.

The method used was essentially the same as reported by Ryabukhin (1). Argon was bubbled through the melt for 20 min. and then evacuated. Hydrogen chloride at 1 atm. pressure was passed through the melt for 30 - 40 min. and allowed to equilibrate for 3 - 5 min. A part of the melt was isolated and flushed with argon. The liberated hydrogen chloride was absorbed in distilled water and titrated against a standard alkali solution.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was prepared by mixing hydrochloric and sulfuric acids. It was dried by passing through concentrated sulfuric acid. Grade A argon was passed over phosphorous pentoxide. Traces of moisture from the two gases were further removed by passing them through a trap cooled in a mixture of alcohol and solid carbon dioxide

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin, Yu. M. Russ. J. Inorg. Chem. 1962, 7, 565.

COMPONENTS:	EVALUATOR:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U. S. A. December, 1989.

CRITICAL EVALUATION:

Six investigations are available (1 - 6) for the solubility of hydrogen chloride in molten NaCl. Novozhilov et al. (3,4) employed a volumetric technique while an elution method was employed by the other investigators. Smoothed data at various temperatures from the different reports are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}					
T/K	Ref.1[a]	Ref.2	Ref.3	Ref.4	Ref.5[a]	Ref.6[a]
1100	(7.17)		12.94	(13.68)	(93.6)	-
1120	7.64		13.17	13.58	79.49	(8.96)
1140	8.11		13.40	13.48	67.88	(9.32)
1160	8.60		13.62	13.39	58.26	9.67
1180	9.10		13.84	13.30	(50.28)	10.03
1200	9.60	10.00[b]	14.05	13.22	(43.57)	10.38
1220	10.11		14.26	13.14		10.72
1240	10.63		14.47	13.06		11.07
1260	11.15		14.67	12.99		11.40
1280	11.68		(14.87)	12.91		11.74
1300	12.20		(15.07)	(12.84)		(12.07)
ΔH/kJ mol^{-1}	36.0	-	9.04	-3.7	-79.9	24.3

Values in ( ) outside temperature interval of experimental measurements; extrapolated by the evaluator.

[a] Values in (mol cm^{-3} atm^{-1}) calculated by the evaluator using density data from Janz, G. J. "**Molten Salts Handbook**", Academic Press, New York, 1967.

[b] At 1203 K

References:

1. Ukshe, E. A.; Devyatkin, V. N. **Russ. J. Phys. Chem.** 1965, **39**, 1222, 1641.

2. Devyatkin, V. N.; Ukshe, E. A. **J. Appl. Chem. U.S.S.R.** 1965, **38**, 1574.

3. Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Russ. J. Phys. Chem.** 1972, **46**, 1066.

4. Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Russ. J. Phys. Chem.** 1972, **46**, 1398.

5. Lukmanova, T. L.; Vil'nyanskii, Ya. E. **Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol.** 1964, **7**, 510.

6. Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanaya, I. H. **Tr. Inst. Elektrokhim. Akad. Nauk. SSSR Ural. Fil.** 1970, **14**, 3.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Sodium chloride; NaCl; [7647-14-5]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration.
Lewis Research Center
Cleveland, Ohio, 44135. U.S.A.
December, 1989.

CRITICAL EVALUATION:

An examination of the preceding table shows that the results of Lukmanova and Vil'nyanskii (5) are too high and are thus rejected. The values of Novozhilov et al. (3,4) also are about 10 - 50% higher than those of other workers (1,2,6) and the data in (3,4) are also rejected. The data from (1,2,6) are in good agreement with each other, and the mean values from (1,2,6) are designated as **recommended** values. These recommended values are given in Table 1 and Fig. 1.

Table 1 - Recommended Numerical Values

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1120	8.30
1140	8.72
1160	9.14
1180	9.57
1200	10.00
1220	10.42
1240	10.85
1260	11.28
1280	11.71
1300	12.14

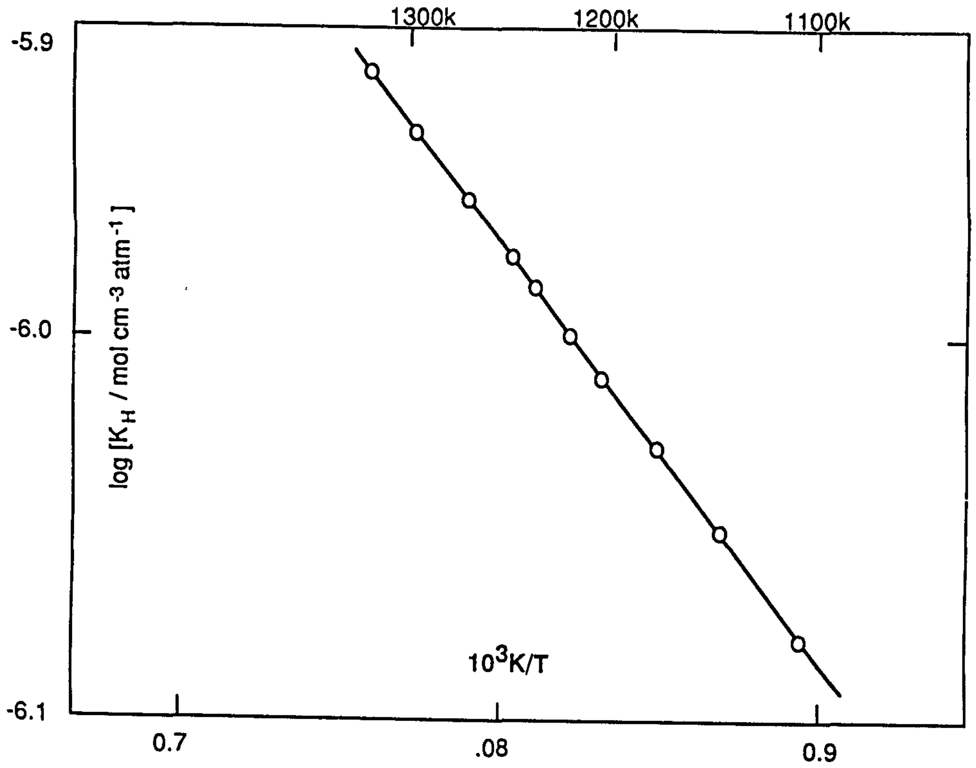


Fig. 1

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Ukshe, E. A.; Devyatkin, V. N.

Zh. Fiz. Khim. 1965, **39**, 2288 - 90;
Russ. J. Phys. Chem. (Eng. Transl.) 1965, **39**, 1222 23. (*).

VARIABLES:

T/K = 1113 - 1300
P/kPa = 101.325 (atm)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, at one atmosphere gas pressure, in molten NaCl at various temperatures are:

t/°C	10^6 x_1/(mol fraction) atm^{-1}
840	32.0
880	32.81
915	30.50
925	36.50
963	42.19
995	46.75
1020	49.72
1030	52.35

Smoothed Data:

Temperature dependence of x_1, in the interval 840 -1030°C, is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = 2.8914 - 1836.9/(T/K)$$ (compiler)

std. dev. = 3.9% (compiler)

The heat of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = +36.0$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping technique. The method used was essentially the same as reported by Ryabukhin (1). Argon was bubbled through the melt for 20 min. and then evacuated. Hydrogen chloride at 1 atm. pressure was passed through the melt for 30 - 40 min. and allowed to equilibrate for 3 - 5 min. A part of the melt was separated and sparged with argon. The liberated hydrogen chloride was absorbed in distilled water and titrated against an alkali solution.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was prepared by mixing hydrochloric and sulfuric acids. It was dried by passing through concentrated sulfuric acid. Grade A argon was passed over phosphorous pentoxide. Traces of moisture from the two gases were further removed by passing them through a trap cooled in a mixture of alcohol and solid carbon dioxide.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin. Yu. M. **Russ. J. Inorg. Chem.** 1962, **7**, 565.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5]	Devyatkin, V. N.; Ukshe, E. A. **Zh. Prikl. Khim.** <u>1965</u>, 38, 1612 - 14; **J. Appl. Chem. U.S.S.R.**(Eng. Transl.) <u>1965</u>, 38, 1574 - 75. (*).
VARIABLES: one temperature: T/K = 1203 P/kPa = 25.331 - 101.325	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The value of the Henry's law constant, K_H, for the solubility of HCl in molten NaCl at a single temperature is:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
930	10

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution Method.

The method used was essentially similar to that described by Ryabukhin (1). The melt was saturated with HCl by bubbling a mixture of hydrogen chloride and argon for 1/2 hour through the melt. After equilibration, the melt was purged with dry argon to liberate the dissolved HCl. The hydrogen chloride which was carried along with the argon was absorbed in distilled water.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride and argon were dried by passing through strong sulfuric acid and over phosphorous pentoxide, respectively. The traces of moisture were further removed by passing the two gases through a coil cooled in a mixture of alcohol and solid carbon dioxide.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin, Yu. M.

   Russ. J. Inorg. Chem. <u>1962</u>, 7, 565.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Devyatkhin, V. N.; Gribova, E. I.
Zh. Fiz. Khim. 1972, **46**, 1856 - 57;
Russ. J. Phys. Chem. (Eng. Transl.) 1972, **46**, 1066 - 67. (*).

VARIABLES:

T/K = 1093 - 1270
P/kPa = 101.325(1 atm)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten NaCl as a function of temperature are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1093	12.86
1113	13.07
1123	13.23
1167	13.67
1213	14.19
1255	13.11
1270	12.97

Smoothed Data:

Temperature dependence of K_H in the range 1093 - 1213 K is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.457 - 474.3/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.08% (compiler)

The enthalpy of solution, ΔH, within the temperature interval 1093 - 1213 K, and the entropy change during dissolution, ΔS, are:

ΔH/kJ mol^{-1} = 9.04 ΔS/J K^{-1} mol^{-1} = 7.7   (at 1173 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

A modification of the experimental method described by Bratland et al. (1) was used.

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by reacting fused NaCl with concentrated sulfuric acid. The gas was purified by fractional condensation.

Recrystallized "chemically pure" grade NaCl was fused in a quartz container in a stream of dry chlorine. Chlorine was purged through the melt for about 2 hours. Then the melt was slowly crystallized under chlorine atmosphere. Only transparent crystals were used for the experiment.

ESTIMATED ERROR:

solubility = ± 1% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.

Acta Chem. Scand. 1966, **20**, 1811.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5]	Novozhilov, A. L.; Devyatkin, V. N.; Gribova, E. I. **Zh. Fiz. Khim.** 1972, **46**, 2433 - 36; **Russ. J. Phys. Chem.** (Eng. Transl.) 1972, **46**, 1398 - 1400. (*).
VARIABLES:	**PREPARED BY:**
T/K = 1123 - 1295 No information on pressure	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of HCl in molten NaCl at different temperatures are:

T/K	10^7 soly/mol cm^{-3}
1123	13.42
1167	13.56
1213	12.97
1295	12.84

Smoothed Data:

Temperature dependence of soly is given by the expression:

$$\log(\text{soly/mol cm}^{-3}) = -6.042 + 195.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.7% (compiler)

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -3.7 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

The diagram and details of the apparatus used and procedure followed are described in the original publication. The melt is saturated with hydrogen chloride. A part of the saturated melt is either flushed with argon or the melt is solidified and the solid salt evacuated. The volume of liberated HCl is then measured with a gas burette.

SOURCE AND PURITY OF MATERIALS:

Condensation method was employed for drying gases.

ESTIMATED ERROR:

solubility = ± 1% (authors)

REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Sodium chloride; $NaCl$; [7647-14-5]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vil'nyanskii, Ya. E

Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Technol. 1964, 7, 510 - 13.

VARIABLES:

$T/K = 1113 - 1173$

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, under one atmosphere pressure, in molten $NaCl$ at two temperatures are:

$t/°C$	$10^4\ x_1/$ (mol fraction) atm^{-1}
840	3.15
900	1.89

Smoothed Data:

Temperature dependence of x_1 in the range 840 - 900°C is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -7.25 + 4180/(T/K)$$

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -79.9$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements have been described in the original paper. The apparatus used was similar to that described by Grimes et al. (1). Dry HCl gas was passed through the melt at a pressure close to atmospheric. After the melt was saturated, the gas supply was cut off. About half of the melt was transferred to the desorber and sparged with dry, deoxygenated N_2. The liberated HCl was absorbed in water and determined by titration.

SOURCE AND PURITY OF MATERIALS:

C. P. grade Sodium chloride was used.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5]	Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanaya, I, M. **Tr. Inst. Elektrokhim. Akad. Nauk. SSSR Ural. Fil.** 1970, 14, 3 - 9.

VARIABLES:	PREPARED BY:
P/kPa = 0.912 T/K = 1151 - 1283	N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of hydrogen chloride in molten NaCl at different temperatures are reported to be:

t/°C	$10^4\ x_1$/(mol fraction) atm^{-1}
878	40
888	44
900	42
920	44
925	46.5
930	41
950	47
963	48
986	51
1000	52
1010	53

Smoothed Data:

Temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -1.29 - 1261/(T/K)$$

The heat of solution, ΔH, and entropy of solution, ΔS, are:

ΔH/kJ mol^{-1} = 24.3 ΔS/J K^{-1} mol^{-1} = -24.7

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

Diagram and details of the apparatus used and procedure followed for gas solubility are given in the original publication. The salt was heated, fused and held under vacuum. The tube was filled with purified HCl gas. After saturation, the melt was flushed with argon. The HCl liberated was absorbed in distilled water and determined by measuring the pH of the solution.

SOURCE AND PURITY OF MATERIALS:

Sodium chloride was dried in vacuum for 10 hours with a gradual temperature rise from 200 - 400°C.

HCl gas was purified by passing through concentrated H_2SO_4 and an acetone dry ice trap.

Argon was dried and purified to remove oxygen and other impurities.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Potassium chloride; KCl; [7447-40-7]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Five studies have been reported (1 - 5) for the solubility of hydrogen chloride in molten KCl. Novozhilov et al. (3) used a volumetric method while the other investigations were carried out employing the elution technique. Smoothed data at various temperatures from the different studies are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}				
T/K	Ref.1[a]	Ref.2	Ref.3	Ref.4[a]	Ref.5[a]
1060	(23.12)		35.90	(53.67)	
1080	(23.54)		35.82	49.24	
1100	(23.94)			45.30	
1120	24.32			41.79	
1140	24.69		34.78	38.65	
1160	25.04			35.82	(21.82)
1180	25.37	24.0[b]	33.75	(33.28)	22.74
1200	25.69			(30.98)	23.66
1220	26.00		34.10		24.58
1240	26.29				25.50
1260	26.56		33.88		26.40
1270	26.69		-		26.86
ΔH/kJ mol^{-1}	12.1	-	-3.8	-33.9	26.8

[a] Values in (mol cm^{-3} atm^{-1}) calculated by the evaluator using density data from Janz, G. J. "Molten Salts Handbook", Academic Press, New York, 1967.

[b] At 1173 K

Values in ( ) outside temperature interval of experimental measurements; extrapolated by the evaluator.

References:

1. Ukshe, E. A.; Devyatkin, V. N. **Russ. J. Phys. Chem.** 1965, 39, 1222, 1641.
2. Devyatkin, V. N.; Ukshe, E. A. **J. Appl. Chem. U.S.S.R.** 1965, 38, 1574.
3. Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Russ. J. Phys. Chem.** 1972, 46, 1066.
4. Lukmanova, T. L.; Vil'nyanskii, Ya. E. **Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Teknol.** 1964, 7, 510.
5. Krasilnokova, N. A.; Smirnov, M. V.; Ozeryanaya, I. H. **Tr. Inst. Elektrokhim. Akad. Nauk SSSR Ural. Fil.** 1970, 14, 3.

continued

COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Potassium chloride; KCl; [7447-40-7]	EVALUATOR: N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

An examination of the preceding table shows that the values of Lukmanova and Vil'nyanskii (4) are too high and are thus rejected. The results of Novozhilov et al. (3) also are 30 - 70% higher than those of references (1) and (5) and the data of (3) are also rejected. The reults of Ukshe and Devyatkin (1) are in agreement with those of Krasilnikova et al. (5), with a maximum difference of 12% at 1180 K. However, the heat of solution of Krasilnikova (5) is more than twice the value reported by Ukshe and Devyatkin (1). The mean values from (1,5) are designated as tentative values. These tentative values are given in Table 1:

Table 1 - Tentative Solubilities as a Function of Temperature

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
1140	22.8
1160	23.4
1180	24.1
1200	24.7
1220	25.3
1240	25.9
1260	26.5
1270	26.8

COMPONENTS:	**ORIGINAL MEASUREMENTS:**
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Potassium chloride; KCl; [7447-40-7]	Ukshe, E. A.; Devyatkin, V. N. **Zh. Fiz. Khim.** 1965, **39**, 2288 - 90; **Russ. J. Phys. Chem.** (Eng. Transl.) 1965, **39**, 1222 - 23. (*).
VARIABLES: P/kPa: 101.325 (1 atm.) T/K = 1113 - 1273	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, under one atmosphere gas pressure, in molten KCl at various temperatures are:

t/°C	$10^6 X_1$/(mol fraction) atm^{-1}
840	125.5
870	117.3
900	120.3
950	130.0
970	138.3
1000	145.5

Smoothed Data:

Temperature dependence of x_1, in the interval 1113 - 1273K, is given by the expression:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -3.3138 - 685.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.2% (compiler)

The heat of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = +\ 12.1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping technique.

The method used was essentially the same as reported by Ryabukhin (1). Argon was bubbled through the melt for 20 min. and then evacuated. Hydrogen chloride at 1 atm. pressure was passed through the melt for 30 - 40 min. and allowed to equilibrate for 3 - 5 min. A part of the melt was isolated and sparged with argon. The liberated hydrogen chloride was absorbed in distilled water and titrated against a standard alkali solution.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was prepared by mixing hydrochloric and sulfuric acids. It was dried by passing through concentrated sulfuric acid. Grade A argon was passed over phosphorous pentoxide. Traces of moisture from the two gases were further removed by passing them through a cold trap immersed in a mixture of alcohol and solid carbon dioxide.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1962, **7**, 565.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Potassium chloride; KCl; [7447-40-7]	Devyatkin, V. N. Ukshe, E. A. **Zh. Prikl. Khim.** 1965, 38, 1612 - 14; **J. Appl. Chem. U.S.S.R.**(Eng. Transl.) 1965, 38, 1574 - 75. (*).
VARIABLES: P/kPa = 20.265 - 101.325 one temperature: T/K = 1173	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The value of Henry's law constant, K_H, for the solubility of HCl in molten KCl at a single temperature is:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
900	24

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

The method used was essentially similar to that described by Ryabukhin (1). The melt was saturated with HCl by bubbling a mixture of hydrogen chloride and and argon. After equilibration, the melt was flushed with dry argon to liberate the dissolved HCl. The freed HCl, which was carried along with the argon, was absorbed in distilled water.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was dried by passing through concentrated sulfuric acid and argon by passing over phosphorous pentoxide. The traces of moisture were further removed by passing the two gases through a coil cooled in alcohol - solid carbon dioxide mixture.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1962, 7, 565.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Devyatkin, V. N.; Gribova, E. I.
Zh. Fiz. Khim. 1972, **46**, 1856 - 57;
Russ. J. Phys. Chem. (Eng. Transl.) 1972, **46**, 1066 - 67. (*).

VARIABLES:

T/K = 1062 - 1260
P/kPa = 101.325 (1 atm)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten KCl at various temperatures are:

T/K	10^7 K_H/ mol cm^{-3} atm^{-1}
1062	35.87
1078	35.83
1109	35.80
1144	34.75
1181	33.77
1223	34.06
1260	33.88

Smoothed Data:

The enthalpy of solution, ΔH, and the change in entropy during dissolution, ΔS, are:

ΔH/kJ mol^{-1} = -3.8

ΔS/J K^{-1} mol^{-1} = -3.5 (at 1150 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

A modification of the experimental method described by Bratland et al. (1) was used for solubility measurements.

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by reacting molten NaCl with concentrated sulfuric acid. The gas was purified by fractional condensation.

Recrystallized "chemically pure" grade KCl was fused in a stream of dry chlorine. The melt was purged with chlorine for about 2 hours. Then the melt was slowly crystallized under chlorine atmosphere. Only transparent crystals were used for the experiment.

ESTIMATED ERROR:

solubility = ± 1% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.

Acta Chem. Scand. 1966, **20**, 1811.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Potassium chloride; KCl; [7447-40-7]	Lukmanova, T. L.; Vilnyanskii, Ya. E. **Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol.** 1964, 7, 510 - 13.
VARIABLES:	**PREPARED BY:**
T/K = 1073 - 1173 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, under one atmosphere pressure, in molten KCl at various temperatures are:

t/°C	10^4 x_1/(mol fraction) atm^{-1}
800	2.50
840	2.15
900	1.75

Smoothed Data:

Temperature dependence of x_1, in the range 800 - 900°C, is expressed by the equation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -5.419 + 1950.4/(T/K)$$ (compiler)

std. dev. = 0.05% (compiler)

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -33.89$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus used and the procedure followed for the gas solubility measurements have been described in the original publication. The apparatus used was similar to that described by Grimes et al. (1). Dry HCl gas was passed through the melt at a pressure close to atmospheric. After the melt was saturated, the gas supply was turned off. About half of the melt was transferred to the desorber and sparged with dry, deoxygenated N_2. The liberated HCl was absorbed in water and determined by titration.

SOURCE AND PURITY OF MATERIALS:

C. P. grade Potassium chloride was used.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862.

COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Potassium chloride; KCl; [7447-40-7]	**ORIGINAL MEASUREMENTS:** Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanaya, I. M. **Tr. Inst. Elektrokhim. Akad. Nauk. SSSR Ural. Fil.** 1970, 14, 3 - 9.
VARIABLES: T/K = 1173 - 1273 P/kPa = 0.912	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of hydrogen chloride in molten KCl at different temperatures are reported as:

t/°C	10^4 x_1/(mol fraction) atm^{-1}
900	126.2
912	129.7
925	135.2
958	145.2
980	151.6
1000	158.2

Smoothed Data:

Temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -0.71 - 1392/(T/K)$$

The heat of solution, ΔH, and the entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 26.8$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = -13.6$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

Diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original publication. The salt was heated, fused and held under vacuum. The tube was filled with purified HCl gas. After saturation, the melt was sparged with argon. The HCl liberated was absorbed in distilled water and determined by measuring the pH of the solution.

SOURCE AND PURITY OF MATERIALS:

Potassium chloride was dried in vacuum for 10 hours with a gradual temperature rise from 200 - 400°C.

HCl gas was purified by passing through concentrated sulfuric acid and an acetone - dry ice trap.

Argon was dried and purified to remove oxygen and other impurities.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Rubidium chloride; RbCl; [7791-11-9]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Four investigations (1 - 4) have been reported for the solubility of hydrogen chloride in molten RbCl. Novozhilov et al. (3) used a volumetric method while the elution technique was employed in the other studies (1,2,4). Smoothed data at different temperatures from the various reports are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}			
T/K	Ref. 1[b]	Ref. 2	Ref. 3	Ref.4[b]
1000	(47.0)			19.6
1030	45.0		55.9	21.8
1060	43.1		54.2	24.0
1100	40.9	42.0[a]	52.3	27.0
1120	39.8		51.3	28.6
1150	38.3		50.1	31.0
1180	36.9		48.9	33.4
1200	36.0		48.1	35.0
1230	34.8		47.1	(37.5)
ΔH/kJ mol^{-1}	-9.2	-	-9.3	32.6

[a] At 1103 K

[b] Values in (mol cm^{-3} atm^{-1}) calculated by the evaluator using density data from Janz, G. J., "**Molten Salts Handbook**", Academic Press, New York, 1967.

Values in ( ) outside temperature interval of experimental measurements;extrapolated by the evaluator.

The value of ΔH reported by Krasilnikova et al. (4) is not only quite high, but also opposite in sign than the other two studies (1,3) whose values are in excellent agreement with each other. But the values of K_H of Ukshe et al. (1) are 20 - 25% smaller in comparison to those of Novozhilov et al. (3).

Further careful work is needed before recommended values can be advanced for this system.

References:

1. Ukshe, E. A.; Devyatkin, V. N. **Russ. J. Phys. Chem.** 1965, 39, 1222.
2. Devyatkin, V. N.; Ukshe, E. A. **J. Appl. Chem. U.S.S.R.** 1965, **38**, 1574.
3. Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Russ. J. Phys. Chem.** 1972, **46**, 1066.
4. Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanaya, I. H. Tr. Inst. Elektrokhim. Akad. Nauk SSSR Ural. Fil. 1970, 14, 3.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Rubidium chloride; RbCl; [7791-11-9]	Ukshe, E. A.; Devyatkin, V. N. Zh. Fiz. Khim. 1965, 39, 2288 - 90; Russ. J. Phys. Chem. (Eng. Transl.) 1965, 39, 1222 - 23. (*).
VARIABLES: T/K = 1033 - 1233 P/kPa: 101.325 (1 atm.)	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, at one atmosphere gas pressure, in molten RbCl at various temperatures are:

t/°C	$10^6\ x_1$/(mol fraction) atm^{-1}
760	240.5
825	232.0
880	221.4
940	202.8
960	202.0

Smoothed Data:

Temperature dependence of x_1, in the range 760 - 960°C, is expressed by the equation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -4.1108 + 515.4/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.9% (compiler)

The heat of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = -9.2$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The method employed was essentially the same as described by Ryabukhin (1). Argon was bubbled through the melt for 20 min. and then evacuated. Hydrogen chloride at 1 atm. pressure was bubbled through the melt for 30 - 40 min. and then allowed to equilibrate for 3 - 5 min. A part of the melt was separated and purged with argon. The liberated hydrogen chloride was absorbed in distilled water and then titrated against a standard alkali solution.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was prepared by mixing hydrochloric and sulfuric acids. It was dried by passing through concentrated sulfuric acid. Quality A argon was passed over phosphorous pentoxide. Traces of mois-ture from the two gases were further removed by passing them through a trap cooled in a mixture of alcohol and solid carbon dioxide.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg. Chem. 1962, 7, 565.

COMPONENTS:	**ORIGINAL MEASUREMENTS:**
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Rubidium chloride; RbCl; [7791-11-9]	Devyatkin, V. N.; Ukshe, E. A. **Zh. Prikl. Khim.** 1965, 38, 1612 - 14; **J. Appl. Chem. U.S.S.R.**(Eng. Transl.) 1965, 38,1574 - 75. (*).
VARIABLES:	**PREPARED BY:**
one temperature: T/K = 1103 P/kPa: 101.325 (compiler)	N. P. Bansal

EXPERIMENTAL VALUES:

The value of the Henry's law constant, K_H, for the solubility of HCl in molten RbCl at one temperature is:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}
830	42

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The method employed was basically similar to that described by Ryabukhin (1). The melt was saturated with HCl by bubbling a mixture of hydrogen chloride and argon. After equilibration, the melt was sparged with dry argon to liberate the dissolved HCl. The freed HCl, which was carried along with argon, was absorbed in distilled water.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was dried by passing through concentrated sulfuric acid and argon by passing over phosphorous pentoxide. Traces of moisture were further removed by passing the two gases through a coil cooled in alcohol - solid carbon dioxide mixture.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin. Yu. M.

Russ. J. Inorg. Chem. 1962, 7, 565.

COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Rubidium chloride; RbCl; [7791-11-9]	ORIGINAL MEASUREMENTS: Novozilov, A. L.; Devyatkin, V. N.; Gribova, E. I. **Zh. Fiz. Khim.** 1972, **46**, 1856 - 57; **Russ. J. Phys. Chem.** (Eng. Transl.) 1972, **46**, 1066 - 67. (*).
VARIABLES: T/K = 995 - 1245 P/kPa = 101.325 (1 atm)	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten RbCl at different temperatures are:

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
995	56.32
1041	56.15
1078	55.75
1113	52.82
1132	49.86
1166	47.81
1245	46.88

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -5.711 + 472.1/(T/K) \qquad \text{(compiler)}$$

std. dev. = 1.4% (compiler)

The enthalpy of solution, ΔH, and the entropy change of dissolution, ΔS, are:

ΔH/kJ mol^{-1} = -9.3 ΔS/J K^{-1} mol^{-1} = -8.4   (at 1110 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

A modification of the experimental technique described by Bratland (1) was used for solubility measurements.

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by reacting molten NaCl with concentrated sulfuric acid. The gas was purified by fractional condensation.

Recrystallized "chemically pure" grade RbCl was fused in a stream of dry chlorine. The melt was purged with chlorine for about 2 hours. Then the melt was slowly crystallized under chlorine atmosphere. Only transparent crystals were used for the experiment.

ESTIMATED ERROR:

solubility = ± 1% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.

Acta Chem. Scand. 1966, 20, 1811.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS:

Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanya, I. M.

Tr. Inst. Elektrokhim. Akad. Nauk. SSSR Ural. Fil. 1970, 14, 3 - 9.

VARIABLES:

P/kPa = 0.912

T/K = 991 - 1215

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of hydrogen chloride in molten RbCl at different temperatures are reported as:

t/°C	$10^4\ x_1$/(mol fraction) atm^{-1}
718	111.0
754	127.5
800	153.8
840	174.7
850	191.2
942	226.4

Smoothed Data:

Temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -0.24 - 1705/(T/\text{K})$$

The heat of solution, ΔH, and the entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 32.6$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = -4.5$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping technique.

Diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original paper. The salt was heated, fused and held under vacuum. The tube was filled with purified HCl gas. After saturation, the melt was sparged with argon. The HCl liberated was absorbed in distilled water and estimated by measuring the pH of the solution.

SOURCE AND PURITY OF MATERIALS:

Rubidium chloride was dried in vacuum for 10 hours with a gradual temperature rise from 200 - 400°C.

HCl gas was purified by passing through concentrated sulfuric acid and an acetone - dry ice trap.

Argon was dried and purified to remove oxygen and other impurities.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Cesium chloride; CsCl; [7647-17-8]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio, 44135. U.S.A.
December, 1989.

CRITICAL EVALUATION:

Two investigations (1,2) are available for the solubility of hydrogen chloride in molten CsCl. Novozhilov et al. (1) used a volumetric method while Krasilnikova (2) employed an elution technique. The values of thermodynamic parameters, ΔH and ΔS, for the dissolution process, reported by the two groups are not only quite different in magnitude but also opposite in sign. Smoothed data at different temperatures from the two sources are compared below:

T/K	10^7 K_H/mol cm^{-3} atm^{-1} Novozhilov et al. (1)	Krasilnikova et al. (2)[a]
940	104.3	16.0
970	96.0	19.0
1000	88.8	22.3
1030	82.5	26.0
1060	77.0	29.9
1100	70.6	35.7
1130	66.5	40.4
1160	62.8	45.3
1190	59.4	(50.5)
1220	56.4	(56.0)

[a] Values in (mol cm^{-3} atm^{-1}) calculated by the evaluator using density data from Janz, G. J., **Molten Salts Handbook"**, Academic Press, New York, 1967.

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

Results of the two studies are seen to be quite different. Further investigations are needed before recommended values can be advanced.

References:

1. Novozhilov, A. L.; Devyatkin, V. N.; Grilova, E. I. **Russ. J. Phys. Chem.** 1972, **46**, 1066.

2. Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanaya, I. H. **Tr. Inst. Elektrokhim. Akad. Nauk SSSR Ural. Fil.** 1970, **14**, 3.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Cesium chloride; CsCl; [7647-17-8]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Devyatkin, V. N.; Gribova, E. I.;
Zh. Fiz. Khim. (Eng. Transl.) 1972, 46, 1856 - 57;
Russ. J. Phys. Chem. 1972, **46**, 1066 - 67. (*).

VARIABLES:

P/kPa = 23.305

T/K = 942 - 1218

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten CsCl at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
942	103.19
978	95.36
1038	84.32
1073	71.65
1130	64.92
1167	61.07
1218	58.63

Smoothed Data:

Temperature dependence of K_H is given by the equation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -6.145 + 1093.5/(T/K)$$ (compiler)

std. dev. = 1.5% (compiler)

The enthalpy of solution, ΔH, and the entropy change of solution, ΔS, are:

ΔH/kJ mol^{-1} = -20.9 ΔS/J K^{-1} mol^{-1} = -19.4 (at 1078 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method.

A modification of the experimental technique described by Bratland et al. (1) was used for solubility measurements.

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by reacting molten NaCl with concentrated sulfuric acid. The gas was purified by fractional condensation.

Recrystallized "chemically pure" CsCl was fused in a stream of dry chlorine. The melt was purged with chlorine for about 2 hours. Then the melt was slowly crystallized under chlorine atmosphere. Only transparent crystals were used for the experiment.

ESTIMATED ERROR:

solubility = ± 1% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.

Acta Chem. Scand. 1966, **20**, 1811.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Cesium chloride; CsCl; [7647-17-8]

ORIGINAL MEASUREMENTS:

Krasilnikova, N. A.; Smirnov, M. V.; Ozeryanaya, I. H.

Tr. Inst. Elektrokhim. Akad. Nauk SSSR Ural. Fil. 1970, 14, 3 - 9.

VARIABLES:

P/kPa = 0.912

T/K = 937 - 1158

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of hydrogen chloride in molten CsCl at different temperatures are reported to be:

t/°C	$10^4\ x_1$/(mol fraction) atm^{-1}
664	100
710	139
750	180
784	211
816	248
850	278
885	315

Smoothed Data:

Temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = 0.71 - 2517/(T/K)$$

The heat of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 48.1$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = +13.6$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

Diagram and details of the apparatus used and procedure followed for gas solubility measurements are given in the original paper. The salt was heated, fused and held under vacuum. The tube was filled with purified HCl gas. After saturation, the melt was flushed with argon. The HCl liberated was absorbed in distilled water and determined by measuring the pH of the solution.

SOURCE AND PURITY OF MATERIALS:

Cesium chloride was dried in vacuum for 10 hours with a gradual temperature rise from 200 - 400°C.

HCl gas was purified by passing through concentrated H_2SO_4 and an acetone - dry ice trap.

Argon was dried and purified to remove oxygen and other impurities.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl;
[7647-01-0]
(2) Magnesium chloride; $MgCl_2$;
[7786-30-3]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.
Zhur. Neorg. Khim. 1983, 29, 218-221.

VARIABLES:

P/kPa = 62.822
T/K = 990 - 1177

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Applicability of Henry's law was checked at only one value of P_{HCl} = 0.62atm. Values of Henry's Law constant K_H (mol $cm^{-3}atm^{-1}$) at various temperatures are listed below. The data obeyed the equation:

$$-\log K_H R'T = \frac{\Delta H}{2.303RT} - \frac{\Delta S}{2.303}$$

as the plot of $-\log K_H R'T$ against 1/T was linear. Here R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH and ΔS are the changes in enthalpy and entropy caused by the introduction of HCl molecules in the melt.

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
990	6.94
1026	7.25
1078	7.67
1136	8.10
1177	8.38

Values of ΔH and ΔS of the dissolution process, evaluated from linear least - squares, are:

$$\Delta H/kJ\ mol^{-1} = 18.7$$

$$\Delta S/JK^{-1}\ mol^{-1} = -5.02$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined using a volumetric method as described earlier(1).

SOURCE AND PURITY OF MATERIALS:

$MgCl_2$ was prepared from sublimed magnesium and doubly distilled "chemically pure" grade hydrochloric acid and purified in the molten state using a special procedure as described in the original paper.

ESTIMATED ERROR:

Solubility = ± 1.5 - 2% (authors)

REFERENCES:

1. Novozhilov, A. L; Devyatkin, V. P; Gribova, E. I.
Zhur. Fiz. Khim. 1972, 46, 1856.

COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Magnesium chloride; $MgCl_2$; [7786-30-3]	**ORIGINAL MEASUREMENTS:** Lukmanova, T. L.; Vilnyanskii, Ya. E. **Izv. Vyssh. Zaved., Khim. i Khim. Tekhnol.** **1964**, **7**, **510 - 13.**
VARIABLES: P/kPa: 101.325 (1 atm.) T/K = 1023 - 1113	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, under one atmosphere pressure, in molten $MgCl_2$ at various temperatures are:

t/°C	$10^4\ x_1$/(mol fraction) atm^{-1}
750	28.1
800	27.0
840	25.0

Smoothed Data:

Temperature dependence of x_1, in the interval 750 - 840°C, is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -3.162 + 627.8/(T/K) \qquad \text{(compiler)}$$

$$\text{std. dev.} = 1.0\% \qquad \text{(compiler)}$$

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -8.41$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus used and procedure followed for the gas solubility measurements have been described in the original paper. The apparatus used was similar to that described by Grimes et al. (1). Dry HCl gas was passed through the melt at a pressure close to atmospheric. After the melt was saturated, the gas supply was cut off. About half of the melt was transferred to the desorber and sparged with dry, deoxygenated N_2. The liberated HCl was absorbed in water and determined by titration.

SOURCE AND PURITY OF MATERIALS:

$MgCl_2$ was C. P. grade and was dehydrated in two steps; first in the drying oven at 280°C in the presence of C. P. NH_4Cl and then in a quartz tube by heating to 800°C in a stream of HCl gas until the basicity of the melt, as determined by titration, was equal to zero.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

   J. Phys. Chem. **1958**, **62**, **862.**

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Calcium chloride; $CaCl_2$; [10043-52-4]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Gribova, E. I.; Devyatkin, V. N.
Zh. Neorg. Khim. 1972, 17, 2570 - 71;
Russ. J. Inorg. Chem. (Eng. Transl.) 1972, 17, 1345 - 46. (*).

VARIABLES:

P/kPa = 60.795 - 101.325

T/K = 1093 - 1275

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten $CaCl_2$ at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1093	2.82
1143	3.45
1190	3.72
1275	4.42

Smoothed Data:

The temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.216 - 1445/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.6% (compiler)

The heat of solution, ΔH. and the entropy change during dissolution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 27.9$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = 25.4 \quad \text{(at 1097 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric method (1).

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by the reaction of fused NaCl with concentrated sulfuric acid. It was purified by fractional condensation.

Recrystallized "chemically pure" grade calcium chloride was dried for several days by gradual heating. Then it was melted and treated with chlorine and transferred to the saturation vessel under a stream of dried and purified argon.

ESTIMATED ERROR:

solubility = ± 3% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.
Acta Chem. Scand. 1966, 20, 1811.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Strontium chloride; $SrCl_2$; [10476-85-4]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Gribova, E. I.; Devyatkin, V. N.
Zh. Neorg. Khim. 1972, 17, 2570 - 71;
Russ. J. Inorg. Chem. (Eng. Transl.) 1972, 17, 1345 - 46. (*).

VARIABLES:

P/kPa = 60.795 - 101.325

T/K = 1163 - 1295

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten $SrCl_2$ at various temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1163	1.85
1204	2.14
1238	2.38
1295	2.78

Smoothed Data:

The temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.997 - 2016/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.3\% \quad \text{(compiler)}$$

The heat of solution, ΔH, and the entropy change during dissolution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 37.9$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = 31.4 \quad \text{(at 1198 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric technique (1).

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by the reaction of fused NaCl with concentrated sulfuric acid. It was purified by fractional condensation.

Recrystallized "chemically pure" grade strontium chloride was dried for several days by gradual heating. It was melted and treated with chlorine and transferred to the saturation vessel under a stream of dry and pure argon.

ESTIMATED ERROR:

solubility = ± 3% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.
Acta Chem. Scand. 1966, 20, 1811.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Barium chloride; $BaCl_2$; [10361-37-2]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Gribova, E. I.; Devyatkin, V. N.
Zh. Neorg. Khim. 1972, 17, 2570 - 71; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1972, 17, 1345 - 46. (*).

VARIABLES:

P/kPa = 60.795 - 101.325

T/K = 1253 - 1351

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of HCl in molten $BaCl_2$ at different temperatures are:

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1253	1.59
1295	1.88
1351	2.17

Smoothed Data:

The temperature dependence of K_H is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -4.941 - 2319/(T/K)$$ (compiler)

std. dev. = 1.1% (compiler)

The heat of solution, ΔH, and the entropy change during dissolution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = 42.1$$

$$\Delta S/\text{J K}^{-1}\ \text{mol}^{-1} = 32.5$$ (at 1295 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Volumetric technique (1).

SOURCE AND PURITY OF MATERIALS:

HCl was prepared by reaction of fused NaCl with concentrated sulfuric acid. It was purified by fractional condensation.

Recrystallized "chemically pure" grade barium chloride was dried for several days by gradual heating. It was melted and treated with chlorine and transferred to the saturation vessel under a stream of dried and purified argon.

ESTIMATED ERROR:

solubility = ± 3% (authors)

REFERENCES:

1. Bratland, D.; Grjotheim, K.; Krohn, C.; Matzfield, K.

Acta Chem. Scand. 1966, 20, 1811.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Tin chloride; $SnCl_4$; [7646-78-8]

ORIGINAL MEASUREMENTS:

Howald, R. A.; Willard, J. E.

J. Amer. Chem. Soc. 1955, 77, 2046 - 49.

VARIABLES:

T/K = 273 - 300

P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of HCl in $SnCl_4$ liquid at two temperatures are:

t/°C	$10^5\ x_1$/mol fraction mm^{-1}
0	6.6 ± 0.5
27	5.2 ± 1.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Pressure measurement.

The solubility of HCl in $SnCl_4$ was measured by determining the the pressure exerted by a known amount of HCl metered into a flask of definite volume containing a known amount of $SnCl_4$.

SOURCE AND PURITY OF MATERIALS:

Tank HCl from Matheson was was passed through a column containing phophorous pentoxide.

"C. P. analyzed anhydrous $SnCl_4$ was distilled through a P_2O_5 column under vacuum and stored.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) N-Methylpyridinium chloride; $CH_3 \cdot C_5H_5N \cdot Cl$; [7680-73-1]

ORIGINAL MEASUREMENTS:

Claes, P. F; Coppe, C. R; Simonis, L. A; Glibert, J. E.

J. Chem. Eng. Data 1987, 32, 70 - 72.

VARIABLES:

T/K = 443
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of HCl at 1 atm pressure is given below

T/K	C_{HCl}/mol lit^{-1}
443	7.47 ± 0.28

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility was determined by saturating the melt by bubbling HCl for 3h. The saturated melt was quenched, dissolved in distilled water, and the excess of KI and KIO_3 were added to the solution which generated an equivalent amount of I_2 according to the reaction:

$$6H_3O^+ + IO^-_3 + 5I^- \rightarrow 9H_2O + 3I_2.$$

The liberated I_2 was estimated by titration with a standard solution of $Na_2S_2O_3$.

SOURCE AND PURITY OF MATERIALS:

Purum grade hydrogen chloride from Fluka was used. In some cases, HCl was prepared by reacting H_2SO_4 (96% from Carlo Erba) of RPE grade with NaCl and bubbled through sulfuric acid.

N-Methylpyridinium chloride was synthesized as described earlier(1).

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Simonis, L; Coppe, C; Glibert, J; Claes, P.
   Thermochim. Acta 1986, 99 223.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) N-Ethylpyridinium bromide; $C_2H_5 \cdot C_5H_5N \cdot Br$; [1906-79-2]

ORIGINAL MEASUREMENTS:

Claes, P. F; Coppe, C. R; Simonis, L. A; Glibert, J. E.

J. Chem. Eng. Data <u>1987</u>, 32, 70 - 72.

VARIABLES:

T/K = 393

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of HCl at 1 atm pressure is given below

T/K	C_{HCl}/mol lit^{-1}
393	6.10

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility was determined by saturating the melt by bubbling HCl for 3h. The saturated melt was quenched, dissolved in distilled water, and the excess of KI and KIO_3 were added to the solution which generated an equivalent amount of I_2 according to the reaction:

$$6H_3O^+ + IO^-_3 + 5I^- \rightarrow 9H_2O + 3I_2.$$

The liberated I_2 was estimated by titration with a standard solution of $Na_2S_2O_3$.

SOURCE AND PURITY OF MATERIALS:

Purum grade hydrogen chloride from Fluka was used. In some cases, HCl was prepared by reacting H_2SO_4 (96% from Carlo Erba) of RPE grade with NaCl and bubbled through sulfuric acid.

N-Ethylpyridinium bromide was synthesized from 99.6% pyridine(Carlo Erba) and 99% ethyl bromide (U. C. B) of P. A grade. For details see the original paper.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis research Center
Cleveland, Ohio, 44135. U.S.A.
December, 1989.

CRITICAL EVALUATION:

Two investigations have been reported for the solubility of hydrogen chloride in molten LiCl - KCl eutectic, using the elution technique. Smoothed data from the two studies at different temperatures are compared below:

	10^7 K_H/mol cm^{-3} atm^{-1}	
T/K	Ref. 1	Ref. 2
680	(9.5)	10.5
710	(10.4)	11.8
740	(11.3)	13.1
770	12.2	14.4
800	13.1	(15.8)
830	14.0	(17.2)
860	14.9	(18.6)
890	15.7	(20.0)
920	16.6	(21.5)
950	17.4	(22.9)
ΔH/kJ mol^{-1}	14.64	15.6

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

There is good agreement between the values of ΔH of the two studies, but the solubility values of Van Norman and Tivers (1) are 10 - 30% lower than those of Minh and Welch (2).

Further experimental studies are needed before recommended values can be advanced for this system.

References:

1. Van Norman, J. D.; Tivers, R. J. **J. Electrochem. Soc.** 1971, **118**, 258.

2. Minh, N. Q.; Welch, B. J. **Aust. J. Chem.** 1975, **28**, 965.

COMPONENTS: (1) Hydrogen chloride; HCl; [7647-01-0] (2) Lithium chloride; LiCl; [7447-41-8] (3) Potassium chloride; KCl; [7447-40-7]	ORIGINAL MEASUREMENTS: Van Norman, J. D.; Tivers, R. J. **J. Electrochem. Soc.** 1971, 118, 258 - 59.
VARIABLES: T/K = 763 - 948 P/kPa: 101.325 (1 atm.)	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of hydrogen chloride in molten eutectic LiCl - KCl, under gas pressure of 1 atm., at three temperatures are:

t/°C	10^6 K_H/mol cm^{-3} atm^{-1}	10^5 x_1/(mol fraction) atm^{-1}
490	1.20 ± 0.14	4.11
570	1.44 ± 0.10	5.05
675	1.74 ± 0.11	6.31

Smoothed Data:

Temperature dependence of K_H is expressed by the relation:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -5.094 - 631.1/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.06% (compiler)

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = 14.64$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The method employed for gas solubility measurements was the same as described elsewhere (2). The melt was first saturated with hydrogen chloride by bubbling the gas through it at a particular gas pressure. A known part of the saturated melt is isolated and flushed with argon to free the dissolved HCl which is collected in water. The HCl solution in water is titrated with a standard NaOH solution.

SOURCE AND PURITY OF MATERIALS:

Reagent grade LiCl and KCl were used.

The LiCl - KCl molten eutectic was prepared by following the method of Laitinen et al. (1).

ESTIMATED ERROR:

solubility ± 10% (authors)

REFERENCES:

1. Laitinen, H. A.; Ferguson, W. S.; Osteryoung, R. A. **J. Electrochem. Soc.** 1957, 104, 516.
2. Van Norman, J. D.; Tivers, R. J. **"Molten Salts: Characterization and Analysis"**, (Mamentov, G. ed.), Marcel Dekker, New York, 1969, 509.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Minh, N. Q.; Welch, B. J.

Aust. J. Chem. 1975, 28, 965 - 73.

VARIABLES:

T/K = 677 - 793

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of HCl in molten LiCl - KCl eutectic (59 - 41 mol%) for an HCl pressure of 101.3kPa at three temperatures are:

T/K	10^6 K_H/mol cm^{-3}
677	1.04
735	1.27
793	1.56

Smoothed Data:

The temperature dependence of K_H is given by the expression:

$$\log(K_H/\text{mol cm}^{-3}\text{ atm}^{-1}) = -4.783 - 814.3/(T/K)$$ (compiler)

std. dev. = 0.7% (compiler)

The heat of solution, ΔH, is estimated to be:

ΔH/kJ mol^{-1} = 15.6 (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The melt was saturated with hydrogen chloride by bubbling the gas through it. A known portion of the saturated melt was isolated and sparged with argon to liberate the dissolved HCl. The HCl, which was carried out along with argon, was absorbed in water and determined by titration with a standard NaOH solution.

SOURCE AND PURITY OF MATERIALS:

HCl gas was prepared by the action of concentrated sulfuric acid on concentrated HCl solution. It was dried by passing through concentrated sulfuric acid scrubbers and demisted by passing through a glass wool filter.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

All the three studies for the solubility of hydrogen chloride in molten NaCl - KCl have employed the same experimental (elution) technique. Ukshe and Devyatkin (1) have studied three melt compositions containing 25, 50, 75 mol% KCl while Lukmanova et al. (3) have used only the equimolar melt. Smoothed data at different temperatures from the three investigations in the equimolar melt are compared below:

	10^5 x_1/mol fraction^{-1} atm^{-1}		
T/K	Ref. 1	Ref. 2	Ref. 3
980	8.89		(98.0)
1020	8.53	8.98[a]	(66.7)
1060	8.21		46.7
1100	7.93		33.6
1140	7.67		(24.7)
1180	7.43		(18.6)
1220	7.22		
1250	7.08		
ΔH/kJ mol^{-1}	-8.6	-	-78.45

[a] At 1023 K

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

Results of Ukshe and Devyatkin (1,2) are quite different than those of Lukmanova et al. (3).

Further experimental measurements are required before recommended values can be advanced for this system.

References:

1. Ukshe, E. A.; Devyatkin, V. N. **Russ. J. Phys. Chem.** 1965, 39, 1641.

2. Devyatkin, V. N.; Ukshe, E. A. **J. Appl. Chem. U.S.S.R.** 1965, 38, 1574.

3. Lukmanova, T. L.; Vil'nyanskii, Ya. E. **Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol.** 1964, 7, 510.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	Ukshe, E. A.; Devyatkin, V. N. **Zh. Fiz. Khim.** 1965, 39, 3074 - 75; **Russ. J. Phys. Chem.** (Eng. Transl.) 1965, 39, 1641 - 42. (*).
VARIABLES:	PREPARED BY:
T/K = 973 - 1273 Melt composition/mol% KCl = 25-75 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of HCl in the molten mixtures NaCl - KCl (25, 50, 75 mol% KCl) at different temperatures are:

Melt Composition/mol% KCl	t/°C	10^6 Soly/mol fraction
25	800	37.7
	845	40.0
	875	42.1
	920	42.4
	950	45.0
	990	46.6
50	700	88.0
	725	86.5
	800	83.3
	850	83.9
	900	76.1
	945	67.9
	970	74.4
	980	68.7

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping technique.

The method used was the same as described earlier (1). Argon was bubbled through the melt followed by evacuation. Hydrogen chloride at 1 atm. pressure was then passed through the melt and allowed to equilibrate. A part of the molten solution was isolated and purged with argon. The liberated hydrogen chloride was absorbed in distilled water and titrated against an alkali solution.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride, prepared by mixing hydochloric and sulfuric acids, was dried by passing through concentrated sulfuric acid. Grade A argon was passed over phosphorous pentoxide. Traces of moisture from the two gases were further removed by passing through a cooled trap immersed in a mixture of alcohol and solid carbon dioxide.

ESTIMATED ERROR:

std. dev. = ± 0.7, ± 2.1, ± 1.0% for 25, 50 and 75 mol % KCl, respectively (compiler)

REFERENCES:

1. Ukshe, E. A.; Devyatkin, Yu. M.

Russ. J. Phys. Chem. 1965, 39, 1222.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen chloride; HCl; [7647-01-0] (2) Sodium chloride; NaCl; [7647-14-5] (3) Potassium chloride; KCl; [7447-40-7]	Ukshe, E. A.; Devyatkin, V. N. **Zh. Fiz. Khim.** 1965, **39**, 3074 - 75; **Russ. J. Phys. Chem.** (Eng. Transl.) 1965, **39**, 1641 - 42. (*).
VARIABLES:	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Melt Composition/mol% KCl	t/°C	10^6 Soly/mol fraction
75	750	109.8
	825	110.8
	875	109.8
	906	106.6
	1000	112.8

Smoothed Data:

Temperature variation of solubility in the ranges studied, obeyed the equation: log(soly/mol fraction) = a + b/(T/K)

Values of the coefficients a and b, along with the enthalpies of dissolution, ΔH, in the three molten mixtures (calculated by the compiler) are:

Melt composition/mol% KCl	a	b	ΔH/kJ mol^{-1}
25	-3.8279	-637.5	12.2
50	-4.5062	448.7	-8.6
75	-3.9335	-28.56	0.55

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]
(2) Sodium chloride; $NaCl$; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Devyatkin, V. N.; Ukshe, E. A.

Zh. Prikl. Khim. 1965, **38**, 1612 - 14; **J. Appl. Chem. U.S.S.R.**(Eng. Transl.) 1965, **38**, 1574 - 75. (*).

VARIABLES:

P/kPa = 20.265 - 101.325
one temperature: T/K = 1023

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The value of Henry's law constant, K_H, for the solubility of HCl in molten $NaCl$ - KCl (50 - 50 mol%) at one temperature is:

t/°C	10^7 K_H/mol cm^{-3} atm^{-1}	10^5 x_1/mol fraction atm^{-1}
750	21	8.98[a]

[a] calculated by the compiler using density data from Janz, G. J., et al. **J. Phys. Chem. Ref. Data** 1975, **4**, 871.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The method employed was essentially similar to that described by Ryabukhin (1). The melt was saturated with HCl by bubbling a mixture of hydrogen chloride and argon. After equilibration, the melt was purged with dry argon to liberate the dissolved HCl. The freed HCl, which was carried along with argon, was absorbed in distilled water.

SOURCE AND PURITY OF MATERIALS:

Hydrogen chloride was dried by passing through concentrated sulfuric acid and argon by passing over phosphorous pentoxide. Traces of moisture were further removed by passing the two gases through a coil cooled in alcohol - solid carbon dioxide mixture.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Ryabukhin, Yu. M.

Russ. J. Inorg.. Chem. 1962, **7**, 565.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vilnyanskii, Ya. E.

Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1964, 7, 510 - 13.

VARIABLES:

T/K = 1023 - 1113
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, under one atmosphere pressure, in molten mixture, NaCl - KCl (50 - 50 mol%) at different temperatures are:

t/°C	$10^4\ x_1$/(mol fraction) atm^{-1}
750	6.24 ± 0.36
800	4.56 ± 0.43
840	2.88 ± 0.24

Smoothed Data:

Temperature dependence of x_1, in the range 750 - 840°C, is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -7.273 + 4179/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 4.7\% \quad \text{(compiler)}$$

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -78.45$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements have been described in the original paper. The apparatus used was similar to that described by Grimes et al. (1). Dry HCl gas was passed through the melt at a pressure close to atmospheric. After the melt was saturated, the gas supply was cut off. About half of the melt was transferred to the desorber and sparged with dry, deoxygenated N_2. The liberated HCl was absorbed in water and determined by titration.

SOURCE AND PURITY OF MATERIALS:

C. P. grade sodium and potassium chlorides were used.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Potassium chloride; KCl; [7447-40-7]

(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vilnyanskii, Ya. E.

Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1964, 7, 510 - 13.

VARIABLES:

T/K = 773 - 1113

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of hydrogen chloride, under one atmosphere pressure, in the molten mixture KCl - $MgCl_2$ (50 -50 mol%) at different temperatures are:

t/°C	10^4 x_1/(mol fraction) atm^{-1}
500	27.65 ± 0.25
550	24.73 ± 0.27
600	24.10 ± 0.10
650	22.25
700	20.96 ± 0.01
750	20.10
800	18.98 ± 0.02
840	17.95 ± 0.65

Smoothed Data:

Temperature dependence of x_1, in the range 500 - 840°C, is expressed by the relation:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -3.143 + 450.5/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.7% (compiler)

The heat of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -9.08$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The diagram and details of the apparatus used and procedure followed for gas solubility measurements have been described in the original publication. The apparatus used was similar to that described by Grimes et al. (1). Dry HCl was passed through the melt at a pressure close to atmospheric. After the melt was saturated, the gas supply was turned off. About half of the melt was transferred to the desorber and sparged with dry, deoxygenated N_2. The liberated HCl was absorbed in water and determined by titration.

SOURCE AND PURITY OF MATERIALS:

Potassium and magnesium chlorides were of C. P. grade. Magnesium chloride was first dried in an oven at 280°C in the presence of C. P. NH_4Cl and then in a quartz tube by heating to 800°C in a stream of HCl gas until the basicity of the melt, as determined by titration, was equal to zero.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Grimes, W. R.; Smith, N. V.; Watson, G. M.

   J. Phys. Chem. 1958, 62, 862.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Potassium chloride; KCl; [7447-40-7]

(3) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Lukmanova, T. L.; Vilnyanskii, Ya. E.

Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1966, 9, 537 - 540.

VARIABLES:

T/K = 773 - 1113

P/kPa = 30.398 - 103.352

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of HCl in molten equimolar KCl - $MgCl_2$ at 500, 600, 700 and 840°C are presented in the form of a figure as a function of pressure. It is not possible to read precise values of solubility from the figure. The solubility values are approximately the same as reported elsewhere by the same workers (1).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution or stripping method.

The apparatus and the method used for gas solubility measurements have been described earlier (1). Dry HCl gas was passed through about 120g of the melt at a rate of 10 l/hr. After saturation, a portion of the melt was transferred into the desorber and flushed with nitrogen. The HCl gas liberated was absorbed in distilled water and determined by titration.

SOURCE AND PURITY OF MATERIALS:

The method of preparation of the anhydrous melt from carnallite has been described earlier (1).

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Lukmanova, T. L.; Vilnyanskii, Ya. E.

   Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. 1964, 7, 510.

COMPONENTS:

(1) Hydrogen chloride; HCl;
[7647-01-0]
(2) Potassium chloride; KCl;
[7447-40-7]
(3) Magnesium chloride; $MgCl_2$
[7786-30-3]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.
Zhur. Neorg. Khim. 1983, **29**, 218-221.

VARIABLES:

T/K = 778 - 1180
$MgCl_2$/mol% = 13 -73

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: Applicability of Henry's law was checked at P_{HCl}=0.62atm. Values of Henry's Law Constant at various temperatures are listed below.

The data obeyed the equation:
$$-\log K_H R'T = \frac{\Delta H}{2.303RT} - \frac{\Delta S}{2.303R}$$
as the plot of $-\log K_H R'T$ against 1/T was linear. Here R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3 atm\ K^{-1}mol^{-1}$, respectively and ΔH and ΔS are the changes in enthalpy and entropy caused by the introduction of HCl molecules in the melt.

Composition of KCl - $MgCl_2$ melt/mol % $MgCl_2$							
13		33		50		73	
T/K	10^7 K_H/mol cm^{-3} atm^{-1}	T/K	10^7 K_H/mol cm^{-3} atm^{-1}	T/K	10^7 K_H/mol cm^{-3} atm^{-1}	T/K	10^7 K_H/mol cm^{-3} atm^{-1}
999	34.86	778	32.82	923	22.55	923	12.74
1035	34.20	833	31.50	970	22.60	975	12.88
1068	33.60	896	30.09	1015	21.76	1021	12.90
1126	32.62	1028	27.46	1074	20.75	1073	13.00
1180	31.72	1077	26.58	1108	20.20	1124	13.03
		1123	25.81	1148	19.60	1153	13.10

Values of ΔH and ΔS of the dissolution process, evaluated from linear least squares are :

Parameter	13 mol% $MgCl_2$	33 mol% $MgCl_2$	50 mol% $MgCl_2$	73 mol% $MgCl_2$
ΔH/kJ mol^{-1}	3.93	2.67	1.35	9.45
ΔS/JK^{-1} mol^{-1}	-6.48	-9.58	-12.88	-9.20

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gas solubilities were determined using a volumetric method as described earlier(1).

SOURCE AND PURITY OF MATERIALS:

$MgCl_2$ was prepared from sublimed magnesium metal and doubly distilled "chemically pure" grade hydrochloric acid and purified in the molten state using a special procedure. For details see the original paper.

ESTIMATED ERROR:

Solubility = ± 1.5 - 2% (authors)

REFERENCES:

1.Novozhilov, A. L; Devyatkin, V. P; Gribova, E. I.
Zhur. Fiz. Khim. 1972, **46**, 1856.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]
(2) Zinc chloride; $ZnCl_2$; [7646-85-7]
(3) N-Methylpyridinium Chloride; $CH_3 \cdot C_5H_5N \cdot Cl$; [7680-73-1]

ORIGINAL MEASUREMENTS:

Claes, P. F; Coppe, C. R; Simonis, L. A; Glibert, J. E.

J. Chem. Eng. Data 1987, **32**, 70 - 72.

VARIABLES:

T/K = 443
P/kPa: 101.325 (1 atm.)
$ZnCl_2$/mol fraction = 0.0 - 0.703

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of HCl in melts of various compositions measured at 443K and 1 atm pressure are listed below :

Melt composition/ mole frac. of $ZnCl_2$	C_{HCl}/mol lit^{-1}	Melt composition/ mole frac. of $ZnCl_2$	C_{HCl}/mol lit^{-1}
0.000	7.47 ± 0.28	0.445	0.29 ± 0.08
0.025	6.75 ± 0.25	0.448	0.30 ± 0.08
0.050	6.22 ± 0.23	0.475	0.35 ± 0.08
0.067	6.01 ± 0.23	0.501	0.40 ± 0.08
0.086	5.90 ± 0.22	0.526	0.33 ± 0.08
0.100	5.68 ± 0.21	0.548	0.22 ± 0.08
0.101	5.38 ± 0.20	0.579	0.32 ± 0.08
0.121	4.96 ± 0.19	0.601	0.29 ± 0.08
0.152	4.46 ± 0.17	0.649	0.32 ± 0.08
0.192	3.76 ± 0.14	0.677	0.34 ± 0.08
0.212	2.95 ± 0.11	0.693	0.29 ± 0.08
0.250	2.18 ± 0.082	0.703	0.28 ± 0.08
0.273	1.78 ± 0.067		
0.367	0.17 ± 0.08		
0.392	0.24 ± 0.08		
0.401	0.28 ± 0.08		
0.419	0.32 ± 0.08		

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility was determined by saturating the melt by bubbling HCl for 3h. The saturated melt was quenched, dissolved in distilled water, and the excess of KI and KIO_3 were added to the solution which generated an equivalent amount of I_2 according to the reaction:

$$6H_3O^+ + IO^-_3 + 5I^- \rightarrow 9H_2O + 3I_2.$$

The liberated I_2 was estimated by titration with a standard solution of $Na_2S_2O_3$.

SOURCE AND PURITY OF MATERIALS:

Purum grade hydrogen chloride from Fluka was used. In some cases, HCl was prepared by reacting H_2SO_4 (96% from Carlo Erba) of RPE grade with NaCl and bubbled through sulfuric acid.

The origin of $ZnCl_2$ was described elsewhere(1).

The synthesis of N-Methylpyridinium chloride was described earlier(1).

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Simonis, L.; Coppe, C.; Glibert, J.; Claes, P.

   Thermochim. Acta 1986, **99**, 223.

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]
(2) Zinc chloride; $ZnCl_2$; [7646-85-7]
(3) N-Ethylpyridinium bromide; $C_2H_5 \cdot C_5H_5N \cdot Br$; [1906-79-2]

ORIGINAL MEASUREMENTS:

Claes, P. F; Coppe, C. R; Simonis, L. A; Glibert, J. E.

J. Chem. Eng. Data 1987, 32, 70 - 72.

VARIABLES:

T/K = 393
P/kPa: 101.325 (1 atm.)
$ZnCl_2$/mol fraction = 0.0 - 0.70

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of HCl in melts of various compositions measured at 393K and 1 atm pressure are listed below :

Melt composition/ mole frac. of $ZnCl_2$	C_{HCl}/mol lit^{-1}
0.000	6.10
0.061	5.63
0.100	4.77
0.187	3.25
0.200	3.29
0.249	2.32
0.300	1.37
0.380	0.39
0.400	0.34
0.500	0.22
0.600	0.21
0.700	0.09

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Solubility was determined by saturating the melt by bubbling HCl for 3h. The saturated melt was quenched, dissolved in distilled water, and the excess of KI and KIO_3 were added to the solution which generated an equivalent amount of I_2 according to the reaction:

$$6H_3O^+ + IO^-_3 + 5I^- \rightarrow 9H_2O + 3I_2.$$

The liberated I_2 was estimated by titration with a standard solution of $Na_2S_2O_3$.

SOURCE AND PURITY OF MATERIALS:

Purum grade hydrogen chloride from Fluka was used. In some cases, HCl was prepared by reacting H_2SO_4 (96% from Carlo Erba) of RPE grade with NaCl and bubbled through sulfuric acid. The origin of $ZnCl_2$ was described elsewhere(1).

N-Ehtylpyridinium bromide was synthesized from 99.6% pyridine (Carlo Erba) and 99% ethyl bromide(U.C.B) of P. A. grade. For details see the original paper.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Simonis, L; Coppe, C; Glibert, J; Claes, P. Thermochim. Acta 1986, 99, 223.

±

COMPONENTS:

(1) Hydrogen chloride; HCl; [7647-01-0]

(2) Lithium chloride; LiCl; [7447-41-8]

continued

ORIGINAL MEASUREMENTS:

Minh, N. Q.; Welch, B. J.

J. Electroanal. Chem. 1978, 92, 179 - 89.

VARIABLES:

T/K = 668 - 773

Melt comp./mol% $ZnCl_2$ = 0 - 17.4

P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of HCl in LiCl - KCl - $ZnCl_2$ melts of different compositions at 723 K, for an HCl pressure of 101.3 kPa (1 atm.) are:

Melt Composition/mol% $ZnCl_2$	10^6 soly/mol cm^{-3}
0	1.24
3.4	1.49
4.7	1.63
8.2	1.78
11.9	2.03
13.5	2.10
17.4	2.19

Values of soly in the melt containing 11.9 mol% $ZnCl_2$ at three temperatures for the HCl pressure of 101.3 kPa are:

T/K	10^6 soly/mol cm^{-3} atm^{-1}
668	2.14
723	2.03
773	1.83

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution technique.

The melt was saturated with hydrogen chloride by bubbling the gas through it. A known portion of the saturated melt was isolated and flushed with argon to liberate the dissolved HCl. The HCl, which was carried out along with argon, was absorbed in water and determined by titration against a standard NaOH solution.

SOURCE AND PURITY OF MATERIALS:

Analytical grade $ZnCl_2$ from May and Baker Limited was used.

Great care was taken in preparing the melts. Purity of the melts was checked voltammetrically.

ESTIMATED ERROR:

solubility = ± 10% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(3) Potassium chloride; KCl; [7447-40-7] (4) Zinc chloride; $ZnCl_2$; [7646-85-7]	Minh, N. Q.; Welch, B. J. J. Electroanal. Chem. 1978, 92, 179 - 89.
VARIABLES:	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Smoothed Data:

Temperature dependence of soly in the melt containing 11.9 mol% $ZnCl_2$ is expressed by the relation:

$$\log(\text{soly}/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.154 + 326.9/(T/K) \qquad \text{(compiler)}$$

$$\text{std. dev.} = 1.2\% \qquad \text{(compiler)}$$

The heat of solution, ΔH, is estimated to be:

$$\Delta H/\text{kJ mol}^{-1} = -6.3 \qquad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitric acid; HNO_3; [7697-37-2]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Haug, H.; Albright, L. F.

Ind. Eng. Chem. Proc. Des. Dev. 1965, 4, 241 - 49.

VARIABLES:

P/kPa: 101.325 (1 atm.)
T/K = 480 - 523

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The simultaneous solubilities of nitric acid and water at 1 atm. total vapor pressure under different partial pressures of nitric acid in the vapor phase have been measured in the molten mixture $NaNO_3$ - KNO_3 (54.3 - 45.7 mol%). The results are reported in graphical form only. The values derived from the graph at different temperatures are:

T/K	Partial Pressure of HNO_3 in Vapor Phase/torr	10^2 Solubility/ mol fraction	10^5 K_H/ mol fraction torr^{-1}
480	152	0.54	3.55
523	152	0.27	1.76
485	289	0.98	3.39
523	289	0.40	1.38

Smoothed Data:
The temperature dependence of x_1 is given by the expression:

$$\log(x_1/\text{mol fraction torr}^{-1}) = -8.92 + 2152/(T/K) \quad \text{(compiler)}$$

The heat of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = -41.2 \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The melt was saturated with vapors of nitric acid. The vapors dissolved in the melt were stripped with a stream of nitrogen and absorbed in tubes containing sodium hydroxide solution.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Data not very precise because of the decomposition of nitric acid.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration.
Lewis Research Center
Cleveland, Ohio, 44135. U.S.A.
December, 1989.

CRITICAL EVALUATION:

Two experimental studies are available (1,2) for the solubility of water in molten lithium nitrate. Data from the two reports are compared below, at the same temperatures:

	10^5 x_1/mol fraction torr^{-1}	
T/K	Peleg (1)	Bertozzi (2)
538	(19.3)	23.2
553	14.6	16.5

Value in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

The results of Peleg (1) are about 15 - 20% lower than those of Bertozzi (2). The former worker has employed the rotating microelectrode voltammetric technique which is not as accurate as the gravimetric method used by the latter. In view of this, the results of Bertozzi (2) may be preferred at least tentatively. However, further studies are needed to resolve this system.

References:

1. Peleg, M. J. Phys. Chem. 1967, 71, 4553.

2. Bertozzi, G. Z. Naturforsch. 1967, 22A 1748.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Peleg, M.

J. Phys. Chem. 1967, 71, 4553 - 56.

VARIABLES:

$T/K = 548 - 608$
$P/kPa = 4.00$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten $LiNO_3$ at different temperatures are:

t/°C	$10^5\ x_1$/mol fraction mm^{-1}
275	16.1
295	11.0
310	8.7
335	5.9

Smoothed Data:

The temperature dependence of x_1 can be expressed by the relation:

$$\log(x_1/\text{mol fraction mm}^{-1}) = -8.188 + 2407/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.6\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -39.1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Voltammetric method.

The melt was obtained in a dry state by evacuation for a long time at a temperature above the experimental temperature. Water vapors at a known pressure were then allowed to enter the system and the melt stirred. The concentration of water in the melt was determined by running a voltammogram.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

solubility: ± 2% (author)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4]	Bertozzi, G. **Z. Naturforsch.** 1967, **22A**, 1748 - 51.

VARIABLES:	PREPARED BY:
$T/K = 538 - 553$ $P/kPa = 0.667 - 4.000$	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water vapor in molten $LiNO_3$ at two different temperatures are:

t/°C	$10^5\ x_1$/mol fraction torr^{-1}
265	23.2
280	16.5

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gravimetric method.

A crucible containing 3 - 5 g of the salt is placed on the balance and the system evacuated. The temperature of the salt is slowly raised beyond its melting point and brought to the desired temperature. The melt is kept under high vacuum for many hours. The vacuum is removed and water vapors are allowed to enter into the system. The system is allowed to equilibrate for a few hours and weighed. The increase in weight directly gives the amount of water dissolved in the melt.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS: (1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	**ORIGINAL MEASUREMENTS:** Peleg, M. **J. Phys. Chem. 1967, 71, 4553 - 56.**
VARIABLES: T/K = 583 - 615 P/kPa = 4.00	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water vapor in molten $NaNO_3$ at different temperatures are:

$t/°C$	$10^5\ x_1$/mol fraction mm^{-1}
310	2.2
333	1.7
342	1.5

Smoothed Data:

The temperature dependence of x_1 can be expressed by the relation:

$$\log(x_1/\text{mol fraction mm}^{-1}) = -7.80 + 1838/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.4%

The enthalpy of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -34.1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Voltammetric method.

The melt was prepared in a dry state by evacuation for a long time at a temperature above the experimental temperature. Water vapors at a known pressure were then allowed to enter the system and the melt stirred. The water concentration in the melt was determined by recording a voltammogram.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

solubility: ± 20% (author)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075 - 77.
VARIABLES: P/kPa = 2.133 - 2.800 one temperature: T/K = 579.8	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten $NaNO_3$ under the water vapor pressure of 16 - 21 mm Hg is given as:

t/°C	10^4 x_1/mol fraction
306.8	14.1 ± 1.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

A modified form of the previously reported (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was evaluated from the freezing point depression.

SOURCE AND PURITY OF MATERIALS:

$NaNO_3$ containing less than 0.0003% of cation and 0.001% of anion impurities was air dried at 240°C for several days and then by the thermal shock technique (1). The salt was melted and the system evacuated or a slow stream of dry nitrogen was passed through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, 251A, 156.

2. Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, 55, 1705.

COMPONENTS:	EVALUATOR:
(1) Water; H_2O; [7732-18-5] (2) Potassium nitrate; KNO_3; [7757-79-1]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Four experimental studies (1 - 4) are available for the solubility of water in molten KNO_3. Their results are compared below:

	$10^5\ x_1$/mol fraction torr^{-1}			
T/K	Ref. 1	Ref. 2	Ref. 3	Ref. 4
608	2.1 ± 0.5			2.1
610		0.20		
619			0.70 ± 0.04	
633				1.6
638			0.51 ± 0.04	

Peleg (2) has pointed out that the results of their study are not correct. Details of the method used by Pchelina and Novozhilov (3) are not available. Although the work of Frame et al. (1) is only of preliminary nature, their results are in good agreement with those of Haug and Albright (4).

The values of ref. (4) may be preferred at least tentatively. However, additional detailed studies are needed to evaluate this system properly.

References:

1. Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075.
2. Peleg, M. **J. Phys. Chem.** 1967, 71, 4553.
3. Pchelina, E. I.; Novozhilov, A. L. **Russ. J. Phys. Chem.** 1976, 50, 1792.
4. Haug, H.; Albright, L. F. **Ind. Eng. Chem. Proc. Des. Dev.** 1965, 4, 241.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Frame, J. P.; Rhodes, E.; Ubbelohde, A. R.

Trans. Faraday Soc. 1961, 57, 1075 - 77.

VARIABLES:

P/kPa = 2.133 - 2.800
one temperature: T/K = 605.05

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten KNO_3 under the water vapor pressure of 16 - 21 mm Hg is given as:

t/°C	10^4 x_1/mol fraction
335.05	3.9 ± 1.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.
A modified form of the previously described (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was calculated from the freezing point depression.

SOURCE AND PURITY OF MATERIALS:

KNO_3 containing less than 0.0003% of cation and less than 0.001% of anion impurities was air dried at 240°C for several days and then by the thermal shock technique (1). The salt was melted and the system evacuated or a slow stream of dry nitrogen was passed through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, 251A, 156.

2. Rhodes, E,; Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, 55, 1705.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Peleg, M.

J. Phys. Chem. 1967, 71, 4553 - 56.

VARIABLES:

$P/kPa = 4.00$

one temperature: $T/K = 610$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten KNO_3 at a single temperature is:

$t/°C$	$10^5\ x_1/\text{mol fraction mm}^{-1}$
337	0.20

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Voltammetric method.

The melt was obtained in a dry state by evacuation for a long time at a temperature above the experimental value. Water vapors at a known pressure were then allowed to enter the system and the melt stirred. The water concentration in the melt was determined by recording a voltammogram.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

The results are incorrect (authors).

REFERENCES:

COMPONENTS: (1) Water; H_2O; [7732-18-5] (2) Potassium nitrate; KNO_3; [7757-79-1]	**ORIGINAL MEASUREMENTS:** Pchelina, E. I.; Novozhilov, A. L. **Zh. Fiz. Khim.** 1976, 50, 3004. **Russ. J. Phys. Chem.** (Eng. Transl.) 1976, 50, 1792. (*).
VARIABLES: T/K = 619 - 638 P/kPa = 6.666	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water vapors in molten KNO_3 at two different temperatures are given as:

t/°C	10^5 x_1/mol fraction
346	0.70 ± 0.04
365	0.51 ± 0.04

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: The method was based on the displacement of the dissolved water vapors with an inert gas. Details of the method are not available.	**SOURCE AND PURITY OF MATERIALS:** Not described.
	ESTIMATED ERROR: solubility: ± 2% (authors)
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Potassium nitrate; KNO_3; [7757-79-1]	Haug, H.; Albright, L. F. **Ind. Eng. Chem. Proc. Des. Dev.** 1965, **4**, 241 - 49.
VARIABLES: P/kPa: 101.325 (1 atm.) T/K = 608 & 633	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water vapor at 1 atm. pressure in molten KNO_3 at two different temperatures are reported in graphical form only. The values derived from the graph by the compiler are:

T/K	10^2 x_1/mol fraction atm^{-1}	10^5 x_1/mol fraction $torr^{-1}$
608	1.6	2.1
633	1.2	1.6

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The melt was saturated with pure steam. The water dissolved in the melt was stripped with a stream of nitrogen and absorbed in tubes containing concentrated H_2SO_4.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

solubility: ± 2% (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water, H_2O; [7732-18-5] (2) Cesium nitrate; $CsNO_3$; [7789-18-6]	Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, **57**, 1075 - 77.
VARIABLES:	PREPARED BY:
P/kPa = 2.133 - 2.800 one temperature: T/K = 679	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten $CsNO_3$ under the water vapor pressure of 16 - 21 mm Hg is given as:

t/°C	10^4 x_1/mol fraction
405.74	9.2 ± 1.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

A modified version of the previously described (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was calculated from the freezing point lowering.

SOURCE AND PURITY OF MATERIALS:

$CsNO_3$ containing less than 0.1% of all impurities was dried for several days in air at 240°C and then by the thermal shock technique (1). The salt was melted and the system evacuated or a slow stream of dry nitrogen was passed through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, **251A**, 156.

2. Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, **55**, 1705.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Sodium nitrite; $NaNO_2$; [7632-00-0]

ORIGINAL MEASUREMENTS:

Kozlowski, T. R.; Bartholomew, R. F.

J. Electrochem. Soc. 1967, 114, 937 - 40.

VARIABLES:

water vapor pressure/mm Hg = 0.143 - 5.053

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten sodium nitrite at the freezing point of $NaNO_2$ is given as:

t/°C	10^5 x_1/mol fraction mm Hg^{-1}
281.5[a]	8.0

[a] Freezing point of $NaNO_2$.

The maximum solubility of water in sodium nitrite at 281.5°C was 31.4×10^{-4} mol fraction.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

The diagram and details of the arrangement and procedure employed are given in the original paper. Depression in the freezing point of sodium nitrite was measured at various vapor pressures of water above the melt. Freezing points were obtained using the cooling curve method.

SOURCE AND PURITY OF MATERIALS:

Baker's "Analyzed" reagent grade sodium nitrite was dried to constant weight in a vacuum oven at 110°C for 7 - 10 days.

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Pchelinia, E. I.
Zhur. Fiz. Khim. 1984, 58, 781-783.
Russ. J. Phys. Chem. (Eng. Transl.). 1984, 58, 477-478. (*).

VARIABLES:

$P/kPa = 6.666$

$T/K = 1095 - 1265$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's Law constant K_H (mol $cm^{-3}atm^{-1}$), for the solubility of water vapors, at various temperatures are given below.
The data obeyed the equation:

$$- \log K_H R'T = \frac{\Delta H}{2.303RT} - \frac{\Delta S}{2.303R}$$

as the plot of $-\log K_H R'T$ against $1/T$ was linear. Here R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH and ΔS are the changes in enthalpy and entropy caused by the introduction of water molecules in the melt.

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
1095	127.4
1116	115.6
1174	94.7
1220	84.3
1265	74.4

Values of the thermodynamic parameters of the dissolution process, evaluated from linear least squares, are

$- \Delta H/kJ\ mol^{-1} = 25.2$

$- \Delta S/JK^{-1}\ mol^{-1} = 22.0$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of purification of the salt and the experimental technique were the same as described elsewhere(1,2). Special care was taken to allow for possible hydrolysis effects on the measured solubility. The strong interaction between the dissolved water molecules and products of hydrolysis could lead to erroneously high solubilities. To suppress hydrolysis, hydrogen chloride was introduced into the vapor - gas mixture of the experiments (Ar - H_2O at P_{H_2O} = 50mm Hg)

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Novozhilov, A. L; Pchelinia, E. I.; Zhur. Fiz. Khim. 1976, 50, 3005.
2. Novozhilov, A. L; Devyatkin, V. N; Gribova, E. I. Zhur. Fiz. Khim. 1972, 46, 1856.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium chloride, NaCl; [7647-14-5]	Bretsznajder, S. **Roczn. Chem.** 1930, **10**, 729 - 35.
VARIABLES:	PREPARED BY:
one temperature: T/K = 1023	N. P. Bansal

EXPERIMENTAL VALUES:

Water reacted with molten NaCl according to the reaction, NaCl + H_2O = NaOH + HCl. The value of the equilibrium constant, K_P, for this reaction at 750°C is 1.6 x 10^{-7}, where K_P is defined as:

$$K_P = \frac{P_{HCl} \times P_{NaOH}}{P_{NaCl} \times P_{H_2O}}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Equilibrium study.	Not described.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Potassium cloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Pchelinia, E. I.
Zhur. Fiz. Khim. 1984, 58, 781-783.
Russ. J. Phys. Chem. (Eng. Transl.).
1984, 58, 477-478. (*).

VARIABLES:

P/kPa = 6.666

T/K = 1086 - 1222

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's Law constant K_H (mol $cm^{-3}atm^{-1}$), for the solubility of water vapors, at various temperatures are given below.

The data obeyed the equation:

$$- \log K_H R'T = \frac{\Delta H}{2.303RT} - \frac{\Delta S}{2.303R}$$

as the plot of $-\log K_H R'T$ against 1/T was linear. Here R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH and ΔS are the changes in enthalpy and entropy caused by the introduction of water molecules in the melt.

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
1086	137.4
1098	132.1
1125	120.2
1170	108.3
1222	93.6

Values of the thermodynamic parameters of the dissolution process, evaluated from linear least squares, are

$- \Delta H/kJ\ mol^{-1} = 21.0$

$- \Delta S/JK^{-1}\ mol^{-1} = 17.7$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of purification of the salt and the experimental technique were the same as described elsewhere(1,2). Special care was taken to allow for possible hydrolysis effects on the measured solubility. The strong interaction between the dissolved water molecules and products of hydrolysis could lead to erroneously high solubilities. To suppress hydrolysis, hydrogen chloride was introduced into the vapor - gas mixture of the experiments (Ar - H_2O at P_{H_2O} = 50mm Hg)

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Novozhilov, A. L; Pchelinia, E. I.
   Zhur. Fiz. Khim. 1976, 50, 3005.
2. Novozhilov, A. L; Devyatkin, V. N; Gribova, E. I.
   Zhur. Fiz. Khim. 1972, 46, 1856.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Pchelinia, E. I.
Zhur. Fiz. Khim. 1984, 58, 781-783.
Russ. J. Phys. Chem. (Eng. Transl.). 1984, 58, 477-478. (*).

VARIABLES:

P/kPa = 6.666

T/K = 1026 - 1198

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's Law constant K_H (mol $cm^{-3}atm^{-1}$), for the solubility of water vapors, at various temperatures are given below.

The data obeyed the equation:

$$-\log K_H R'T = \frac{\Delta H}{2.303RT} - \frac{\Delta S}{2.303R}$$

as the plot of $-\log K_H R'T$ against 1/T was linear. Here R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH and ΔS are the changes in enthalpy and entropy caused by the introduction of HCl molecules in the melt.

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
1026	171.8
1075	151.6
1124	136.3
1161	126.3
1198	109.2

Values of the thermodynamic parameters of the dissolution process, evaluated from linear least squares, are

$-\Delta H/kJ\ mol^{-1} = 16.2$

$-\Delta S/JK^{-1}\ mol^{-1} = 12.6$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of purification of the salt and the experimental technique were the same as described elsewhere(1,2). Special care was taken to allow for possible hydrolysis effects on the measured solubility. The strong interaction between the dissolved water molecules and products of hydrolysis could lead to erroneously high solubilities. To suppress hydrolysis, hydrogen chloride was introduced into the vapor - gas mixture of the experiments (Ar - H_2O at P_{H_2O} = 50mm Hg)

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Novozhilov, A. L; Pchelinia, E. I.
Zhur. Fiz. Khim. 1976, 50, 3005.

2. Novozhilov, A. L; Devyatkin, V. N; Gribova, E. I.
Zhur. Fiz. Khim. 1972, 46, 1856.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Cesium chloride; CsCl;
[7647-17-8]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.; Pchelinia, E. I.
Zhur. Fiz. Khim. 1984, 58, 781-783.
Russ. J. Phys. Chem. (Eng. Transl.)
1984, 58, 477-478. (*).

VARIABLES:

P/kPa = 6.666

T/K = 974 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's Law constant K_H (mol $cm^{-3}atm^{-1}$), for the solubility of water vapors, at various temperatures are given below. The data obeyed the equation:

$$-\log K_H R'T = \frac{\Delta H}{2.303RT} - \frac{\Delta S}{2.303R}$$

as the plot of $-\log K_H R'T$ against 1/T was linear. Here R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH and ΔS are the changes in enthalpy and entropy caused by the introduction of water molecules in the melt.

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
974	195.2
1023	178.4
1078	159.1
1124	147.1
1173	134.9

Values of the thermodynamic parameters of the dissolution process, evaluated from linear least-squares, are

$$-\Delta H/kJ\ mol^{-1} = 8.8$$
$$-\Delta S/JK^{-1}\ mol^{-1} = 5.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method of purification of the salt and the experimental technique were the same as described elsewhere(1,2). Special care was taken to allow for possible hydrolysis effects on the measured solubility. The strong interaction between the dissolved water molecules and products of hydrolysis could lead to erroneously high solubilities. To suppress hydrolysis, hydrogen chloride was introduced into the vapor - gas mixture of the experiments (Ar - H_2O at P_{H_2O} = 50mm Hg)

SOURCE AND PURITY OF MATERIALS:

Not specified.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Novozhilov, A. L; Pchelinia, E. I.; **Zhur. Fiz. Khim.** 1976, 50, 3005.
2. Novozhilov, A. L; Devyatkin, V. N; Gribova, E. I. **Zhur. Fiz. Khim.** 1972, 46, 1856.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium Bromide; NaBr; [7647-15-6]	Novozhilov, A. L. **Zhur. Fiz. Khim.** 1985, 59, 1008-1009; **Russ. J. Phys. Chem.** (Eng. Transl.) 1985, 59, 586 - 587. (*).
VARIABLES:	PREPARED BY:
T/K = 1053 - 1220	N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of water in the melt was directly proportional to its partial pressure in the gaseous mixture indicating the applicability of Henry's law under the experimental conditions. Henry's Law constants K_H (mole $cm^{-3}atm^{-1}$) at various temperatures, measured at P_{H_2O} = 187.5mm Hg, are given below.

The data obeyed the equation:

$$\log K_H R'T = \frac{-\Delta H^\circ}{2.303RT} + \frac{\Delta S^\circ}{2.303R}$$

where R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and $\Delta H^\circ$and ΔS° are the standard enthalpy and entropy changes accompanying the transfer of 1 mole of water vapors from the gas phase to the bromide melt.

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1053	187.1
1097	152.7
1132	138.9
1181	113.6
1220	100.0

Values of the thermodynamic parameters are :

$-\Delta H^\circ$/kJ mol^{-1} = 30.9 $\qquad$ $-\Delta S^\circ/JK^{-1}$ mol^{-1} = 25.3

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water solubility was determined by a procedure involving displacement by an inert gas, as described earlier(1).
A gaseous mixture of H_2O + Ar(P_{H_2O} = 50 - 200mm Hg) was bubbled through the melt. To prevent hydrolysis of the melt, HBr was introduced into the gas mixture to a partial pressure of 15mm Hg.

SOURCE AND PURITY OF MATERIALS:

"Chemically pure" or "analytical grade salt was recrystallized twice from doubly distilled water, dried in vacuum at a steadily increasing temperature and then fused. The last operations were repeated twice immediately before the measurements. HBr was prepared as described earlier(2), and was sublimed in vacuum at liquid nitrogen temperatture.

ESTIMATED ERROR:

Solubility = 3 - 5% (authors)

REFERENCES:

1. Pchelinia, E. I.; Novozhilov, A. L; **Zhur. Fiz. Khim.** 1976, 50, 3005.
2. Muller, G.; Gnauk, G. **"High Purity Gases"**, 1968.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Potassium Bromide; KBr;
[7758-02-3]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.
Zhur. Fiz. Khim. 1985, **59**, 1008-1009;
Russ. J. Phys. Chem. (Eng. Transl.)
1985, **59**, 586-587. (*).

VARIABLES:

T/K = 1041 - 1211

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of water in the melt was directly proportional to its partial pressure in the gaseous mixture indicating the applicability of Henry's law under the experimental conditions. Henry's Law constants K_H (mole $cm^{-3}atm^{-1}$) at various temperatures, measured at P_{H_2O} = 187.5mm Hg, are given below.

The data obeyed the equation

$$\log K_H R'T = \frac{-\Delta H^\circ}{2.303RT} + \frac{\Delta S^\circ}{2.303R}$$

where R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH° and ΔS°are the standard enthalpy and entropy changes accompanying the transfer of 1 mole of water vapors from the gas phase to the bromide melt.

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
1041	206.9
1086	183.3
1123	162.9
1176	129.0
1211	115.9

Values of the thermodynamic parameters are :

$-\ \Delta H^\circ/kJ\ mol^{-1} = 26.0$

$-\ \Delta S^\circ/JK^{-1}\ mol^{-1} = 20.3$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water solubility was determined by a procedure involving displacement by an inert gas, as described earlier(1). A gaseous mixture of H_2O + Ar(P_{H_2O} = 50 - 200mm Hg) was bubbled through the melt. To prevent hydrolysis of the melt, HBr was introduced into the gas mixture to a partial pressure of 15mm Hg.

SOURCE AND PURITY OF MATERIALS:

"Chemically pure" or "analytical grade salt was recrystallized twice from doubly distilled water, dried in vacuum at a steadily increasing temperature and then fused. The last two operations were repeated twice immediately before the measurements.

HBr was prepared as described earlier(2), and was sublimed in vacuum at liquid nitrogen temperature.

ESTIMATED ERROR:

Solubility = 3-5 % (authors)

REFERENCES:

1. Pchelina, E. I.; Novozhilov, A. L;
Zhur. Fiz. Khim. 1976, **50**, 3005.
2. Muller, G.; Gnauk, G.
"High Purity Gases", 1968.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Rubidium Bromide; RbBr; [7789-39-1]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.
Zhur. Fiz. Khim. 1985, 59, 1008-1009;
Russ. J. Phys. Chem. (Eng. Transl.) 1985, 59, 586-587. (*).

VARIABLES:

T/K = 1001 - 1204

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of water in the melt was directly proportional to its partial pressure in the gaseous mixture indicating the applicability of Henry's law under the experimental conditions. Henry's Law constants K_H mole $cm^{-3}atm^{-1}$) at various temperatures, measured at P_{H_2O} = 187.5mm Hg, are given below.

The data obeyed the equation:

$$\log K_H R'T = \frac{-\Delta H^\circ}{2.303RT} + \frac{\Delta S^\circ}{2.303R}$$

where R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH° and $\Delta S^\circ$are the standard enthalpy and entropy changes accompanying the transfer of 1 mole of water vapors from the gas phase to the bromide melt.

T/K	10^7 K_H/mol cm^{-3} atm^{-1}
1001	241.1
1043	208.9
1118	165.4
1177	140.1
1204	130.5

Values of the thermodynamic parameters are :

$- \Delta H^\circ/kJ\ mol^{-1} = 21.2$

$- \Delta S^\circ/JK^{-1}\ mol^{-1} = 15.5$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water solubility was determined by a procedure involving displacement by an inert gas, as described earlier(1). A gaseous mixture of H_2O + Ar(P_{H_2O} = 50 - 200mm Hg) was bubbled through the melt.
To prevent hydrolysis of the melt, HBr was introduced into the gas mixture to a partial pressure of 15mm Hg.

SOURCE AND PURITY OF MATERIALS:

"Chemically pure" or "analytical grade salt was recrystallized twice from doubly distilled water, dried in vacuum at a steadily increasing temperature and then fused. The last two operations were repeated twice immediately before the measurements.

HBr was prepared as described earlier(2), and was sublimed in vacuum at liquid nitrogen temperature.

ESTIMATED ERROR:

Solubility = 3-5 % (authors)

REFERENCES:

1. Pchelina, E. I.; Novozhilov, A. L.
Zhur. Fiz. Khim. 1976, 50, 3005.
2. Muller, G.; Gnauk, G.
"High Purity Gases", 1968.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Cesium Bromide; CsBr; [7787-69-1]

ORIGINAL MEASUREMENTS:

Novozhilov, A. L.
Zhur. Fiz. Khim. 1985, 59, 1008-1009;
Russ. J. Phys. Chem. (Eng. Transl.) 1985, 59, 586-587. (*).

VARIABLES:

T/K = 923 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubility of water in the melt was directly proportional to its partial pressure in the gaseous mixture indicating the applicability of Henry's law under the experimental conditions. Henry's Law constants K_H mole $cm^{-3}atm^{-1}$) at various temperatures, measured at P_{H_2O} = 187.5mm Hg, are given below.

The data obeyed the equation:

$$\log K_H R'T = \frac{-\Delta H^\circ}{2.303RT} + \frac{\Delta S^\circ}{2.303R}$$

where R and R' are the gas constants in $JK^{-1}mol^{-1}$ and in $cm^3atm\ K^{-1}mol^{-1}$, respectively and ΔH° and $\Delta S^\circ$are the standard enthalpy and entropy changes accompanying the transfer of 1 mole of water vapors from the gas phase to the bromide melt.

T/K	$10^7\ K_H$/mol cm^{-3} atm^{-1}
923	318.7
981	289.0
1027	225.0
1108	178.3
1173	150.9

Values of the thermodynamic parameters are :

$-\Delta H^\circ/kJ\ mol^{-1} = 18.3$

$-\Delta S^\circ/JK^{-1}\ mol^{-1} = 12.5$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water solubility was determined by a procedure involving displacement by an inert gas, as described earlier(1). A gaseous mixture of $H_2O + Ar(P_{H_2O} = 50 - 200$mm Hg) was bubbled through the melt. To prevent hydrolysis of the melt, HBr was introduced into the gas mixture to a partial pressure of 15mm Hg.

SOURCE AND PURITY OF MATERIALS:

"Chemically pure" or "analytical grade salt was recrystallized twice from doubly distilled water, dried in vacuum at a steadily increasing temperature and then fused. The last two operations were repeated twice immediately before the measurements.

HBr was prepared as described earlier(2), and was sublimed in vacuum at liquid nitrogen temperature.

ESTIMATED ERROR:

Solubility = 3-5 % (authors)

REFERENCES:

1.Pchelinia, E. I.; Novozhilov, A. L; **Zhur. Fiz. Khim.** 1976, 50, 3005.
2.Muller, G.; Gnauk, G. **" High Purity Gases "**, 1968.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Lithium perchlorate; $LiClO_4$; [7791-03-9]

ORIGINAL MEASUREMENTS:

Duke, F. R.; Doan, Jr., A. S.

Iowa State Coll. J. Sci. 1958, 32, 451 - 53.

VARIABLES:

T/K = 513 - 563

P/kPa = 7.999 (max)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water vapor was a linear function of its pressure. The solubility of water vapors in molten $LiClO_4$ at different temperatures are:

t/°C	10^6 x_1/mol(mol of Li^+)$^{-1}$ mm of Hg^{-1}
240	54.9
260	28.5
290	20.2

Smoothed Data:

The temperature dependence of x_1 can be expressed by the relation:

$$\log(x_1/\text{mol(mol of Li}^+)^{-1}\text{ mm Hg}^{-1}) = -9.067 + 2447.3/(T/K) \quad \text{(compiler)}$$

std. dev. = 8.2% (compiler)

The enthalpy of solution, ΔH, for the solubility of water vapors is:

$$\Delta H/\text{kJ mol}^{-1} = -37.66 \pm 14.6$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

Water vapors at the desired pressure were introduced into the apparatus above the molten salt. The fall in pressure, due to the solubility of water vapors in the melt, was measured as a function of time until the equilibrium was attained. The amount of water dissolved in the melt was evaluated from the initial and final values of the pressure.

SOURCE AND PURITY OF MATERIALS:

Not described.

About 10 g of the salt was taken and vacuum dried. The temperature was raised slowly above the melting point and brought to the working temperature. Evacuation of the melt was continued for several hours to ensure complete drying.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Sodium hydroxide; NaOH; [1310-73-2]

ORIGINAL MEASUREMENTS:

Hoyt, E. B.
J. Chem. Eng. Data, 1967, 12, 461 - 464.

VARIABLES:

$T/K = 630 - 688$

$P/kPa = 1.013 - 59.595$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of water, C_{H_2O} (wt%), in molten NaOH measured at three different temperatures under various vapor pressures of water, p_{H_2O} (mm of Hg), in molten NaOH are given below :

367°C		390°C		415°C	
p_{H_2O}/mm Hg	C_{H_2O}/wt%	p_{H_2O}/mm Hg	C_{H_2O}/wt%	p_{H_2O}/mm Hg	C_{H_2O}/wt%
147	0.528	339	0.830	447	0.774
136.7	0.500	325	0.772	397	0.715
127.1	0.474	283	0.720	375	0.660
123.0	0.450	257	0.678	343	0.607
117.7	0.426	238	0.640	305	0.558
110.7	0.404	229	0.607	279	0.513
100.6	0.386	207	0.565	256	0.473
99.7	0.366	198	0.532	228	0.438
92.3	0.347	178	0.496	205	0.402
84.8	0.321	164	0.466	181	0.362
80.8	0.316	150	0.433	160	0.324
75.8	0.295	142	0.397	141	0.289
67.1	0.269	127	0.364	124	0.258
60.4	0.241	115	0.310	113	0.231
52.0	0.212	106	0.287	98.8	0.207
44.7	0.183	93.6	0.257	83.0	0.179
36.3	0.155	85.6	0.222	69.5	0.147
31.6	0.129	72.6	0.187	50.9	0.117

cont'd...

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A Gas saturation method was used for measurement of the solubility of water under various vapor pressures of water in the gas phase. For details of the apparatus and the procedure used, see the original publication.

SOURCE AND PURITY OF MATERIALS:

Sodium hydroxide(97.6%) of commercial grade having ≈ 2.4% total impurities on a dry basis(Na_2CO_3, 1.0; NaCl, 0.4; Na_2SO_4, 0.3; and Na_2SiO_3, 0.7%) was used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Al-Muslih, E.; Iredale, P. J.; Maund, J. K.
J. Chem. Eng. Data, 1983, 28, 245.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium hydroxide; NaOH; [1310-73-2]	Hoyt, E. B. J. Chem. Eng. Data, 1967, 12, 461 - 464.
VARIABLES: T/K = 630 - 688 P/kPa = 1.013 - 59.595	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

contd ....

367°C		390°C		415°C	
p_{H_2O}/mm Hg	C_{H_2O}/wt%	p_{H_2O}/mm Hg	C_{H_2O}/wt%	p_{H_2O}/mm Hg	C_{H_2O}/wt%
21.3	0.087	59.7	0.187	39.5	0.089
11.5	0.045	44.6	0.149	28.6	0.063
7.6	0.031	31.1	0.114	13.7	0.033
		24.0	0.083	8.3	0.016
		16.7	0.058		
		10.6	0.037		

From the above data, Al-Muslih(1) et. al, determined Henry's Law constants (atm mol^{-1} Kg) at 367 and 415°C to be 0.63 and 1.20.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium hydroxide; NaOH; [1310-73-2]	Rahmel, A.; Kruger, H. -J. Z. Physik, Chem. 1967, 55, 25 - 32.
VARIABLES: T/K = 623 - 773 no information on pressure	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Temperature dependence of the Henry's law constant k in $mg \cdot g^{-1} \cdot Torr^{-1}$ for the solubility of water in molten NaOH is given as :

$$\log k = -6.54 + \frac{3210}{T}$$

Where T is the temperature in kelvin.

The above results have also been expressed[1] as :

$$\log K = 4.88 - \frac{3210}{T}$$

Where K is the Henry's law constant in $atm \cdot mol^{-1} \cdot kg$, and T is the temperature in kelvin.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gravimetry.

The amount of water dissolved in the melt was measured as a function of vapor pressure of water in the gas phase.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

1. Al-Muslih, E.; Iredale, J.; Maund, J. K.
   J. Chem. Eng. Data 1983, 28, 245.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Bertozzi, G.

Z. Naturforsch. 1967, 22A, 1748 - 51.

VARIABLES:

$T/K = 503 - 553$
$P/kPa = 0.667 - 4.000$
melt comp./mol% $LiNO_3$ = 25 - 75

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water vapors in molten $LiNO_3$ - $NaNO_3$ mixtures of various compositions at different temperatures are:

Melt Composition/ mol% $LiNO_3$	10^5 x_1/mol fraction torr^{-1}		
	230	265	280
25	-	8.4	6.4
50	24.2	11.0	8.1
75	35.4	16.5	11.8

Smoothed Data:

The temperature dependence of x_1 in molten $LiNO_3$ - $NaNO_3$ mixtures containing 50 and 75 mol% $LiNO_3$are expressed, by the equations:

50 mol% $LiNO_3$: $\log(x_1/\text{mol frac. torr}^{-1}) = -8.871 + 2645/(T/K)$ (compiler)

75 mol% $LiNO_3$: $\log(x_1/\text{mol frac. torr}^{-1}) = -8.687 + 2636/(T/K)$ (compiler)

The heat of solution, ΔH, in both melts is estimated to be:

$\Delta H/\text{kJ mol}^{-1} = -50.5$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gravimetric method.

A crucible containing 3 - 5 g of the salt mixture is placed on the balance and the system evacuated. The temperature of the salt is raised slowly beyond its melting point and set to the working temperature. The melt is kept under high vacuum for many hours. The vacuum is disconnected and water vapors are allowed to enter the system to a definite pressure. After equilibrium is attained, the salt is weighed again. The increase in weight directly gives the amount of water dissolved in the melt.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3, [7757-79-1]	N. P. Bansal National Aeronautics and Space Administration. Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Four investigations have been reported (1 - 4) for the solubility of water in molten $LiNO_3$ - KNO_3. Aganesova et al. (4) have used polarography which is not a very reliable method for solubility determinations. Also, their values are not in line with the other studies (1 - 3) and are rejected.

Bertozzi (3) has carried out measurements in three melt compositions, containing 25, 50 and 75 mol% $LiNO_3$, using a gravimetric method. His results for equimolar melt composition are in excellent agreement with those reported by Tripp et al. (1,2) who employed an indirect technique of vapor pressure measurements.

The recommended numerical values for the equimolar melt composition, based on the data sets of refs. (1 - 3); are given in Table 1 and also shown in Fig. 1. Tentative values for solubilities in melts containing 25 and 75 mol% $LiNO_3$ are also presented in Fig. 1.

Table 1

Recommended Solubilities in Equimolar $LiNO_3$ - KNO_3 Melt as a Function of Temperature

T/K	10^4 x_1/mol fraction $torr^{-1}$
380	45.0
400	22.5
420	12.0
440	6.8
460	4.0
480	2.5
500	1.6
520	1.1
540	0.74

References:

1. Tripp, T. B. J. **Chem. Thermodyn.** 1975, 7, 263.
2. Tripp, T. B. Braunstein, J. J. **Phys. Chem.** 1969, 73, 1984.
3. Bertozzi, G. Z. **Naturforsch.** 1967, 22A, 1748.
4. Aganesova, S. B. Ladani, P.; Yurkinskii, V. P.; Morachevskii, A. G. **Zhur. Priklad. Khim.** 1975, 48, 1164.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

(3) Potassium nitrate; KNO_3; [7757-79-1]

EVALUATOR:

N. P. Bansal
National Aeronautics and Space Administration
Lewis Research Center
Cleveland, Ohio, 44135, U.S.A.
December, 1989.

CRITICAL EVALUATION:

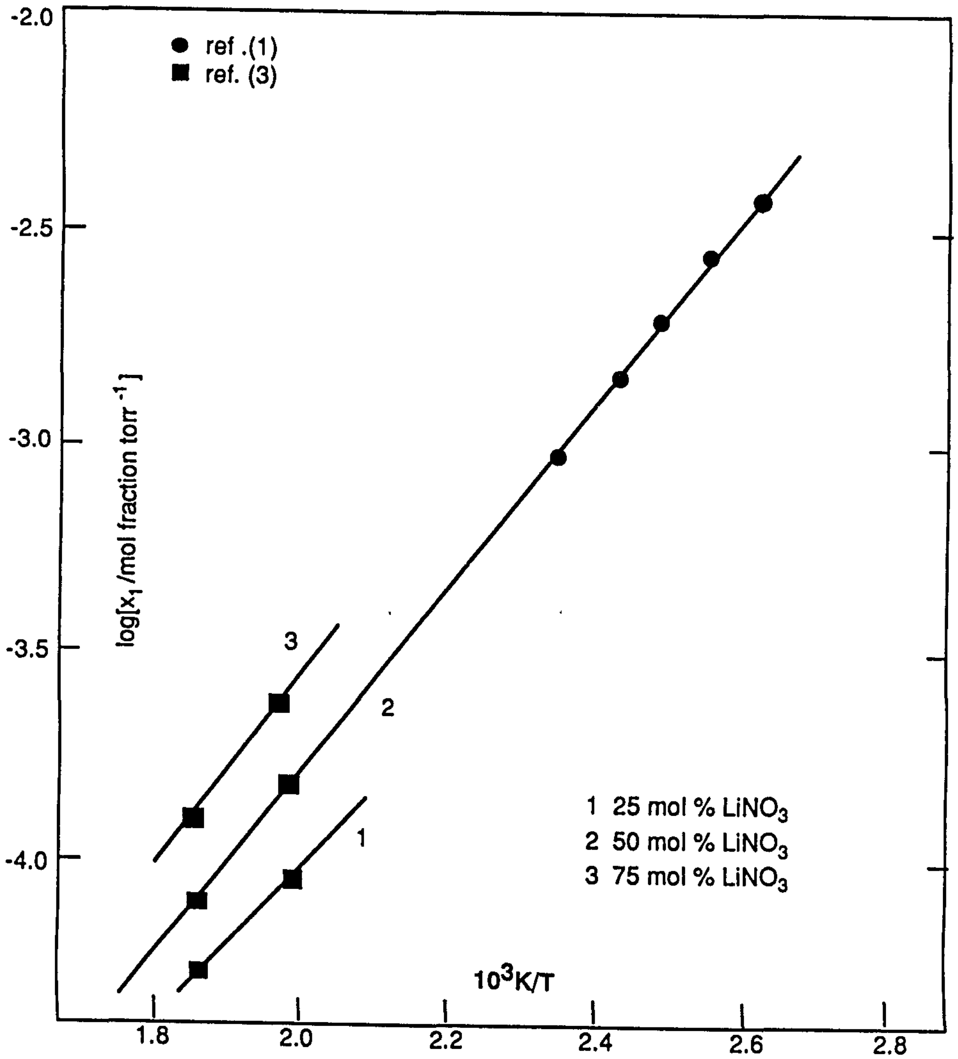


Fig. 1

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Tripp, T. B.; Braunstein, J. J. Phys. Chem. 1969, 73, 1984 - 90.
VARIABLES:	PREPARED BY:
T/K = 392 - 423 melt comp./mol% $LiNO_3$ = 50.0 P/kPa: 101.325 (compiler)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water in the molten mixture $LiNO_3$ - KNO_3 (50 - 50 mol%) have been reported in the temperature range 392 - 423 K in the form of a linear graph.

The values of x_1 derived from the graph at different temperatures by the compiler are:

T/K	$10^4\ x_1/\text{mol}(\text{mol of }NO_3^-)^{-1}\ \text{torr}^{-1}$
392	29.6
403	20.5
413	15.1
423	10.9

Smoothed Data:

The temperature dependence of K_H can be expressed by the equation:

$$\log(x_1/\text{mol}(\text{mol of }NO_3^-)^{-1}\ \text{torr}^{-1}) = -8.416 + 2308/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.5\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, is given as:

$$\Delta H/\text{kJ mol}^{-1} = -43.1 \pm 0.84$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Vapor pressure measurements. The solubility data have been indirectly derived from vapor pressure measurements of the system $LiNO_3$ - KNO_3 - H_2O using a differential transpiration method.	Not described.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Tripp, T. B.

J. Chem. Thermodyn. 1975, 7, 263 - 69.

VARIABLES:

T/K = 383 - 423
melt comp./mol% $LiNO_3$ = 50.0
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water in molten $LiNO_3$ - KNO_3 (50 - 50 mol%) mixture at different temperatures are:

T/K	10^4 x_1/mol fraction $torr^{-1}$
383.15	40.1
392.15	29.3
402.15	20.5
413.15	14.8
423.15	10.9

Smoothed Data:

The temperature dependence of K_H can be expressed by the relation:

$$\log(x_1/\text{mol fraction torr}^{-1}) = -8.376 + 2291/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.14% (compiler)

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = -43.9 \pm 0.4$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Vapor pressure measurements.

The solubilities of water have been indirectly derived from vapor pressure measurements of $LiNO_3$ - KNO_3 - H_2O system using a differential transpiration method described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Lithium and potassium nitrates, Mallinckrodt AR grade, were dried at 520 K.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J.
J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Tripp, T. B. **Molten Salts** [J. P. Pemsler, et al, Eds.], The Electrochem. Soc., Princeton, NJ. 1976, p. 560 - 574.
VARIABLES:	**PREPARED BY:**
T/K = 402.1 Melt composition/mol Li^+ per mol NO_3^- = 0.4493 - 0.7000	N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of $LiNO_3$ - KNO_3 - H_2O melts over a wide range of water concentrations and melt compositions have been measured at 129.51°C. The water mole ratio, R_H (mol H_2O/mol NO_3^-), was varied from ≈ 0.2 to 1.0 mol H_2O/ mol NO_3^- and the salt mole fraction, R_L(mol Li^+/mol NO_3^-), was varied from 0.4493 to 0.7000 mol Li^+/mol NO_3^-.

The results can be expressed in terms of the relation:

$$P = A + B R_H$$

Where P is the vapor pressure in torr, and A and B are constants. Values of the coefficients A and B for various melt compositions expressed in terms of R_L are given below:

R_L/mol Li^+ per mol NO_3^-	A	B
0.45	2.68	524.8
0.50	-1.24	491.3
0.55	-4.94	453.9
0.60	-10.35	418.9
0.65	-11.96	392.1
0.70	-12.8	359.5

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described previously(1,2), was used for measurements of the vapor pressure of water.

SOURCE AND PURITY OF MATERIALS:

$LiNO_3$ and KNO_3 both from Mallinckrodt (AR grade) were finely ground, dried for 24h. at 150°C and stored over anhydrous magnesium perchlorate.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J. **J. Phys. Chem.** 1969, 73, 1984.
2. Tripp, T. B. **J. Chem. Thermodynamics** 1975, 7, 263.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Bertozzi, G.

Z. Naturforsch. 1967, **22A**, 1748 - 51.

VARIABLES:

T/K = 503 - 538
P/kPa = 0.667 - 4.000
water vapor pressure/torr = 5 - 30

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water vapors in molten $LiNO_3$ - KNO_3 mixtures of different compositions at two different temperatures are:

	10^5 x_1/mol fraction torr^{-1}	
melt composition/mol% $LiNO_3$	230	265
25	9.9	5.4
50	16.2	8.2
75	27.8	13.7

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Gravimetric method.

A crucible containing 3 - 5 g of the salt mixture is placed on the balance and the system evacuated. The temperature of the salt is raised slowly beyond its melting point and set to the desired temperature. The melt is kept under high vacuum for many hours. The vacuum is disconnected and water vapors are allowed to enter the system to a definite pressure. After equilibrium is reached, the salt is weighed again. The increase in weight directly gives the amount of water dissolved in the melt.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Aganesova, S. B.; Ladani, P.; Yurkinskii, V. P.; Morachevskii, A. G.
Zhur. Priklad. Khim. 1975, **48**, 1164 - 65.

VARIABLES:

T/K = 420 - 603
P/kPa = 2.026

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in the molten eutectic $LiNO_3$ - KNO_3 has been studied in the temperature range 420 - 603 K. Henry's law was obeyed only in the temperature interval 513 - 603 K and the results have been reported in the form of a plot. Values of solubility derived from the plot at some experimental temperatures, by the compiler, are:

T/K	10^5 x_1/mol fraction torr^{-1}
516	34.7
542	17.4
559	14.3
585	8.5
606	7.4

Some results are also reported for the water concentration in the melt saturated with water in the temperature range 420 - 463 K. However, for these solubilities the water content in the vapor phase is not known,

Smoothed Data:

The temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction torr}^{-1}) = -8.052 + 2351/(T/K) \quad \text{(compiler)}$$

std. dev. = 4.6% (compiler)

The enthalpy of solution, ΔH, in the temperature range 513 - 603 K is:

ΔH/kJ mol^{-1} = -43.9

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Voltammetric method.

A known amount of the mixed salt was fused and dried by bubbling dry nitrogen through the melt for one hour. The melt was saturated with water by sparging it with nitrogen saturated with vapor (water vapor pressure = 15.20 torr). Then the voltammogram was recorded. The method of standard additions was employed for determining the amount of water present in the melt corresponding to the wave height recorded. The additive used was $(NH_4)_2CO_3.H_2O$.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135, U.S.A. December, 1989.

CRITICAL EVALUATION:

Three studies (1 - 3) are available for the solubility of water in molten $NaNO_3$ - KNO_3. Haug and Albright (3) used the melt composition containing 54.3 mol% $NaNO_3$. The results of the other two investigations, which employed equimolar melts, are compared in Fig. 1. It may be noted that the results of White and Twardoch (2), obtained by using the cyclic voltammetric technique, are in reasonable agreement with those of Zambonin et al. (1) who employed the pressure measuring technique.

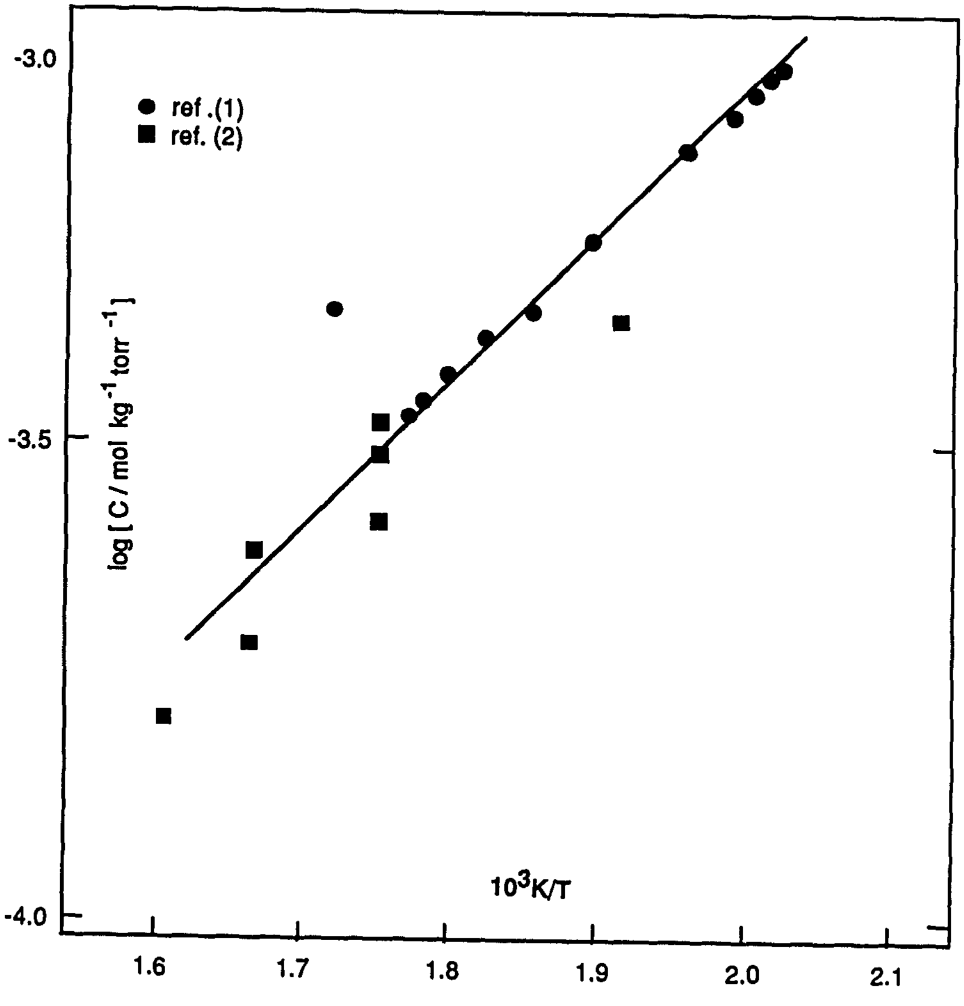


Fig. 1

COMPONENTS:	EVALUATOR:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

The recommended values, obtained from the two data sets (1,2), in the equimolar melt are given in Table 1:

Table 1

Recommended Solubilities in the Equimolar $NaNO_3$ - KNO_3 Melt as a Function of Temperature

T/K	10^4 C/mol kg^{-1} $torr^{-1}$
500	9.29
510	7.87
520	6.72
530	5.76
540	4.97
550	4.32
560	3.76
570	3.30
580	2.90
590	2.57
600	2.28

References:

1. Zambonin, P.G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** 1970, **28**, 237.

2. White, S. H.; Twardoch, U. M. **Proc. Third Intl. Symp. Molten Salts (Mamantov, G.; Blander, M.; Smith, G. P., Eds.)** 1981, 284.

3. Haug, H.; Albright, L. F. **Ind. Engg. Chem. Proc. Des. Dev.** 1965, **4**, 241.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Zambonin, P. G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** 1970, 28, 237 - 43.
VARIABLES: T/K = 500 - 567 P/kPa = 1.320 - 2.740	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solvent employed was an equimolar molten mixture of sodium nitrate and potassium nitrate. The data for the solubility of water in the melt at various temperatures and water vapor temperatures are:

T/K	P_{H_2O}/torr	10^3 x_1/mol kg^{-1}	10^4 K_P/mol kg^{-1} $torr^{-1}$
500	9.90	9.40	9.50
501	10.30	9.30	9.05
503	10.50	9.25	8.80
506	10.95	9.15	8.35
514	11.95	8.95	7.50
527	13.95	8.50	6.10
537	15.75	8.10	5.15
547	17.40	7.75	4.45
556	18.80	7.45	3.95
563	20.05	7.20	3.60
567	20.55	7.10	3.45

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Pressure measuring technique. The diagram and details of the apparatus and procedure used for solubility measurements are described in the original paper. Briefly, the melt was evacuated fro a long time for degassing. The vacuum was disconnected and water vapors at a known pressure were introduced. The melt was stirred vigorously and the system allowed to attain equilibrium. The number of moles of water dissolved in the melt was calculated from the equilibrium pressure.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Zambonin, P. G.; Cardetta, V. L.; Signorile, G. **J. Electroanal. Chem.** 1970, 28, 237 - 43.
VARIABLES: T/K = 500 - 567 P/kPa = 1.320 - 2.740	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

The temperature dependence of the constant K_P is given by the relation:

$$\log(K_P/\text{mol kg}^{-1}\text{ torr}^{-1}) = -6.716 + 1843/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.5\% \quad \text{(compiler)}$$

The heat of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = -35.1$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = -37.2 \quad \text{(at 523 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

White, S. H.; Twardoch, U. M.

Proc. Third Intl. Symp. Molten Salts (Mamantov, G.; Blander, M.; Smith, G. P., Eds.) 1981, 284 - 94.

VARIABLES:

$T/K = 523 - 623$
$P/kPa = 1.072 - 4.242$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of water in molten equimolar $NaNO_3$ - KNO_3 mixture were measured at different temperatures under various partial pressures of water. The values of the solubility constant, K, are:

T/K	P_{H_2O}/torr	10^4 K/mol kg^{-1} torr^{-1}
523	20.94	4.6
573	9.21	3.4
573	19.35	3.1
573	20.82	2.5
573	31.82	2.4
598	8.04	1.1
598	20.94	2.0
623	20.94	1.4

Smoothed Data:
Temperature dependence of K is expressed by the relation:

$$\log(K/\text{mol kg}^{-1}\text{ torr}^{-1}) = -6.723 + 1780.1/(T/K) \quad \text{(compiler)}$$

std. dev. = 6.9% (compiler)

The heat of the solution, ΔH, is $\Delta H/\text{kJ mol}^{-1} = -34.1$ (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cyclic voltammetry.

SOURCE AND PURITY OF MATERIALS:

Sodium and potassium nitrates were either ultrapure or P_2O_5 dried ACS grade. These were further dried under vacuum at temperatures up to 200°C. To prepare the melt, the salt mixture was melted under pure oxygen, evacuated and filtered.

Water added was in the form of $LiNO_3.3H_2O$ or saturated argon gas at a known partial pressure.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Haug, H.; Albright, L. F. **Ind. Eng. Chem. Proc. Des. Dev.** 1965, 4, 241 - 49.
VARIABLES: T/K = 473 - 623 water vapor press./torr = 80 - 750	PREPARED BY: N. P.Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed upto a vapor pressure of 1 atm. for the solubility of water vapor in molten $NaNO_3$ - KNO_3 (54.3 - 45.7 mol%). Values of water solubility at different temperatures are:

T/K	$10^2\ x_1{}^a$/ mol fraction atm^{-1}	$10^5\ x'_1{}^a$/ mol fraction $torr^{-1}$
473	11.60	15.3
523	4.79	6.3
573	2.43	3.2
623	1.41	1.9

^{a} Values derived from the graph by the compiler.

Smoothed Data:

The temperature dependence of x_1 and x'_1 can be expressed by the relations:

$$\log(x_1/\text{mol fraction atm}^{-1}) = -4.747 + 1798.5/(T/K) \quad \text{(compiler)}$$

$$\log(x'_1/\text{mol fraction torr}^{-1}) = -7.596 + 1783/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.5% (compiler)

The heat of solution, ΔH, is reported to be:

$$\Delta H/\text{kJ mol}^{-1} = -34.94$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Stripping method. The melt was saturated with pure steam at a particular pressure. The steam dissolved in the melt was stripped with a stream of nitrogen and absorbed in tubes containing concentrated H_2SO_4	Not described.
	ESTIMATED ERROR: solubility: ± 2% (authors)
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]

ORIGINAL MEASUREMENTS:

Frame, J. P.; Rhodes, E.; Ubbelohde, A. R.

Trans. Faraday Soc. 1961, 57, 1075 - 77.

VARIABLES:

P/kPa = 10.666 - 9.999
one temperature: T/K = 572

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in the molten mixture $NaNO_3$ - $Ca(NO_3)_2$ (95.98 - 4.02 mol%) under the water vapor pressure 16 - 21 mm Hg is given as:

t/°C	10^4 x_1/mol fraction
298.67	20.0 ± 2.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

A modified version of the previously described (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was calculated from the freezing point depression.

SOURCE AND PURITY OF MATERIALS:

$NaNO_3$ containing less than 0.0003% of cation and less than 0.001% of anion impurities was air dried at 240°C for several days and then by thermal shock technique (1). The calcium nitrate (Laboratory Reagent) was air dried as above. The two salts were mixed in proper amounts and melted. The melt was dried either by evacuation or by passing a slow stream of dry N_2 through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, 251A 156.

2. Rhodes, E.: Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, 55, 1705.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Potassium nitrate; KNO_3; [7757-79-1] (3) Barium nitrate; $Ba(NO_3)_2$; [10022-31-8]	Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075 - 77.
VARIABLES: P/kPa = 2.133 - 2.800 melt comp./mol% $Ba(NO_3)_2$ = 0.94 & 4.17	**PREPARED BY:** N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water in the molten mixtures KNO_3 - $Ba(NO_3)_2$ at two different compositions under the water vapor pressure of 16 - 21 mm Hg are given as:

Melt composition/ mol% $Ba(NO_3)_2$	t/°C	10^4 x_1/ mol fraction
0.94	332.13	6.0 ± 2.0
4.17	321.64	4.2 ± 2.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

A modified form of the previously reported (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was calculated from the freezing point depression.

SOURCE AND PURITY OF MATERIALS:

KNO_3 containing less than 0.0003% of cation and less than 0.001% of anion impurities was air dried at 240°C for several days and then by the thermal shock technique (1).

$Ba(NO_3)_2$ (Analytical Reagent) was air dried as above. The two salts were mixed in proper ratio and melted. The melt was dried either by evacuation or by passing a slow stream of dry N_2 through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, 251A, 156.

2. Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, 55, 1705.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Cesium nitrate; $CsNO_3$; [7789-18-6]
(3) Barium nitrate; $Ba(NO_3)_2$; [10022-31-8]

ORIGINAL MEASUREMENTS:

Frame, J. P.; Rhodes, E.; Ubbelohde, A. R.

Trans. Faraday Soc. 1961, 57, 1075 - 77.

VARIABLES:

P/kPa = 2.133 - 2.800
one temperature: T/K = 664

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in the molten mixture $CsNO_3$ - $Ba(NO_3)_2$ (95.67 - 4.33 mol%) under the water vapor pressure of 16 - 21 mm Hg is given as:

t/°C	10^4 x_1/mol fraction
391.00	6.3 ± 2.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

A modified form of the previously described (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was calculated from the freezing point lowering.

SOURCE AND PURITY OF MATERIALS:

$CsNO_3$ having less than 0.1% of all impurities was dried for several days in air at 240°C and then by the thermal shock technique.

$Ba(NO_3)_2$ (Analytical Reagent) was air dried as above. The two salts were mixed in proper amounts and melted. The melt was dried either by evacuation or by passing a slow stream of dry nitrogen through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, 251A, 156.

2. Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, 55, 1705.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]

(2) Silver nitrate; $AgNO_3$; [7761-88-8]

(3) Thallium nitrate; $TlNO_3$; [10102-45-1]

ORIGINAL MEASUREMENTS:

Trudelle, M. C.; Abraham, M.; Sangster, J.
Can. J. Chem. 1977, 55, 1713 - 1719.

VARIABLES:

T/K = 371.5

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law constant, K_H was calculated from the equation :

$$f = f_w^{\circ}\ r_w^{\alpha}\ x_w = K_H x_w$$

Where f is the fugacity of vapor, f_w° is the fugacity of pure water r_w^{α} is the activity coefficient of water at infinite dilution in the melt, and x_w is the mole fraction of water in the melt solution.

The value of K_H for water in the $AgNO_3$ - $TlNO_3$ melt (mol $H_2O)^{-1}$ with Ag/Tl mole ratio of 1.14 at 100°C was calculated to be 1.3 atm. mol melt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A static technique was used for vapor pressure measurement. For a description of the apparatus and the procedure, see the original paper.

SOURCE AND PURITY OF MATERIALS:

Not given.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Potassium nitrate; KNO_3; [7757-79-1]
(3) Sodium nitrite; $NaNO_2$; [7632-00-0]

ORIGINAL MEASUREMENTS:

Hull, H. S.; Turnbull, A. G.

J. **Phys. Chem.** 1970, **74**, 1783 - 87.

VARIABLES:

T/K = 416 - 551.6
P/kPa = 0.667 - 3.200

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed for the solubility of water. The solubilities of water in molten KNO_3 - $NaNO_2$ (46 - 54 mol%) mixture as a function of temperature are:

t/°C	$10^5\ x_1$/mol fraction $torr^{-1}$
142.9	61.0
149.8	52.4
160.1	38.1
180.8	24.2
201.0	16.7
220.9	11.3
239.8	8.12
260.1	5.92
278.5	4.62

Smoothed Data:

The temperature dependence of x_1 can be expressed by the relation:

$$\log(x_1/\text{mol fraction torr}^{-1}) = -7.782 + 1897/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.2% (compiler)

The heat of solution, ΔH, and entropy of solution, ΔS, are:

ΔH/kJ mol^{-1} = -36.3 (compiler)
ΔS/J K^{-1} mol^{-1} = -38.5 (compiler) at 523K.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Elution method.

At a fixed temperature, a known amount of the melt was saturated with water by bubbling a stream of nitrogen which was presaturated with water to a known pressure. After saturation, the melt was sparged with dry nitrogen to strip water from the melt. The eluted gas mixture of nitrogen and water was passed through two drying tubes containing magnesium perchlorate and the amount of water absorbed was determined by the increase in weight of the drying tubes.

SOURCE AND PURITY OF MATERIALS:

Analar reagent grade KNO_3 and $NaNO_2$, air dried at 150°C, were used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrite; KNO_2; [7757-79-1]

ORIGINAL MEASUREMENTS:

Tripp, T. B.
J. Electrochem. Soc. 1987, 134, 848 - 855.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 383.15 - 402.66

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of the melt system $LiNO_3$ - KNO_2 - H_2O were measured at three different temperatures for three melt compositions and expressed as R_L (moles Li^+ per mole of salt) as a function of the water mole ratio.

Values of the Henry's law constant k_H for the composition R_L = 0.5 are given below at various temperatures

T/K	k_H/kPa·mol salt·(mol H_2O)$^{-1}$
383.15	36.18
391.91	47.98
402.66	70.65

The enthalpy of vaporization of water from the melt with R_L = 0.5 was calculated to be 44.4 kJmol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described earlier(1), was used for vapor pressure measurements.

SOURCE AND PURITY OF MATERIALS:

Reagent grade Lithium nitrate was dried at 423K for several days.

Reagent grade Potassium nitrite was dried at 363K, pulverized, and redried at 373K.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J. J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Burkhard, W. J.; Corbett, J. D.

J. Amer. Chem. Soc. 1957, 79, 6361 - 63.

VARIABLES:

T/K = 663 - 753
P/kPa = 0.400 - 3.466
water vapor press./mm = 3 - 26

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in molten LiCl - KCl mixtures of different compositions at two temperatures are:

Melt Composition/ mol% LiCl	10^6 x_1/mol(mol of LiCl)$^{-1}$mm^{-1}	
	390°C	480°C
50.0	30.0	14.0[a]
53.0	--	11.8
60.0	30.5	11.3
68.6	--	10.8

[a] Value doubtful

Henry's law was obeyed upto a water vapor pressure of 14 mm at 390°C and 18 mm at 480°C.

Smoothed Data:

The values of heats of solution, ΔH, are:

Melt Composition/mol% LiCl	ΔH/kJ mol^{-1}
50.0	-33.47
60.0	-46.02

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

Water vapors at a known pressure were introduced into the system above the melt. The fall in pressure of water vapors due to the solubility in the melt was noted. The solubility was calculated from initial and final equilibrium values of the pressure.

SOURCE AND PURITY OF MATERIALS:

LiCl from Baker or Baker and Adamson, and KCl from Baker were used.

The LiCl - KCl mixed melts were prepared in the dry state by using a modification of the procedure described by Laitinen et al. (1), which involved alternate evacuation and flushing with HCl gas a number of times.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Laitinen, H. A.; Ferguson, W. S.; Osteryoung, R. A.

J. Electrochem. Soc. 1957, 104, 516.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Potassium nitrate; KNO_3; [7757-79-1]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Haug, H.; Albright, L. F.

Ind. Eng. Chem. Proc. Des. Dev. 1965, 4, 241 - 49.

VARIABLES:

one temperature: T/K = 598
P/kPa: 101.325 (1 atm.)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water vapor at 1 atm. pressure in molten KNO_3 in the presence of 6 mol% Cl^- ions at a single temperature, read from the graph in the original paper, is:

T/K	$10^2\ x_1$/ mol fraction atm^{-1}	$10^5\ x_1$/ mol fraction $torr^{-1}$
598	1.8[a]	2.36[a]

[a] Values derived from graph by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The melt was saturated with pure steam at a particular pressure. Steam dissolved in the melt was stripped with a stream of nitrogen and absorbed in tubes containing concentrated H_2SO_4.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

solubility: ± 2% (authors)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium hydroxide; NaOH; [1310-73-2]
(3) Potassium hydroxide; KOH; [1310-58-3]

ORIGINAL MEASUREMENTS:

Al-Muslih, E; Iredale, P. J; Maund, J. K
J. Chem. Eng. Data 1983, **28**, 245-246

VARIABLES:

T/K = 523 - 723
KOH/ mol% = 36.9
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Values of Henry's Law constant for the solubility of water in a melt consisting of 63.1 mole% NaOH and 36.9 mol% KOH were determined from Henry's Law : $P_{H_2O} = k N_{H_2O}$

Where P_{H_2O} is the partial pressure of H_2O in nitrogen, N_{H_2O} is the amount of H_2O dissolved in the melt (mol kg^{-1}), and k is the Henry's Law constant (atm mol^{-1} kg). The values of k at various temperatures are given below:

T/K	10^7 k/atm mol^{-1} Kg	Std. dev.
523	0.0095	0.001
573	0.0290	0.002
623	0.1200	0.030
673	0.3500	0.090
723	0.6600	0.200

Temperature dependence of k is given by the relation:

$$\ln k = 10.8 - \frac{8081}{T}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Water solubilities in the NaOH - KOH melt of eutectic composition were determined at various temperatures using a gravimetric method. For a diagram of the apparatus and details of the procedure used see the original paper.

SOURCE AND PURITY OF MATERIALS:

AnalaR-grade NaOH and KOH were used.
Cylinder N_2 was passed through a column of NaOH pellets (to remove CO_2) followed by another column containing Union Carbide "Type 4A" molecular sieve and self-indicating silica gel to remove H_2O.

ESTIMATED ERROR:

Std. dev. 0.001 - 0.20(authors).

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Potassium nitrate; KNO_3; [7757-79-1] (3) Potassium dichromate; $K_2Cr_2O_7$; [7778-50-9]	Frame, J. P.; Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1961, 57, 1075 - 77.
VARIABLES: P/kPa = 2.133 - 2.800 one temperature: T/K = 602	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of water in the molten mixture KNO_3 - $K_2Cr_2O_7$ (98.1 - 1.9 mol%) at water vapor pressure of 16 - 21 mm Hg is given to be:

t/°C	10^4 x_1/mol fraction
329.05	6.0 ± 2.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Cryoscopic method.

A modified version of the previously described (2) cryoscopic apparatus was used. Nitrogen was employed as the carrier gas for water vapors. Freezing point of the same melt sample was determined, first with pure nitrogen, and then with nitrogen containing known partial pressures of water. Solubility of water in the melt was calculated from the freezing point depression.

SOURCE AND PURITY OF MATERIALS:

KNO_3 containing less than 0.0003% of cation and less than 0.001% of anion impurities was air dried at 240°C for several days and then by the thermal shock technique (1).

Potassium dichromate was Analytical Reagent grade. The two salts were mixed in proper amounts and melted. The melt was dried either by evacuation or by passing a slow stream of dry nitrogen through the melt for 24 hr.

ESTIMATED ERROR:

Nothing specified

REFERENCES:

1. Rhodes, E.; Ubbelohde, A. R. **Proc. Royal Soc.** 1959, 251A 156.

2. Rhodes, E.; Ubbelohde, A. R. **Trans. Faraday Soc.** 1959, 55, 1705.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium acetate; CH_3COONa; [127-09-3]
(3) Potassium acetate; CH_3COOK; [127-08-2]

ORIGINAL MEASUREMENTS:

Marassi, R.; Bartocci, V.; Pucciarelli, F. Cescon, P.

J. Electroanal. Chem. 1973, 47, 509 - 19.

VARIABLES:

$T/K = 527 - 561$
melt comp./mol% CH_3COONa = 46.3
$P/kPa = 0.267 - 2.000$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of water vapors in molten sodium acetate - potassium acetate mixture (46.3 - 53.7 mol%), Henry's law was obeyed for water vapor pressures upto 20 torr in the temperature range 527 - 561 K. The values of solubility, C_1, at different temperatures are:

T/K	10^3 C_1/mol kg^{-1} torr^{-1}
526.9	1.13
531.2	1.04
537.8	0.94
545.9	0.81
552.2	0.73
554.5	0.69
560.9	0.63

Smoothed Data:

The temperature dependence of C is given by the expression:

$$\log(C_1/\text{mol kg}^{-1}\ \text{torr}^{-1}) = -7.148 + 2213.7/(T/K) \quad \text{(compiler)}$$
$$\text{std. dev.} = 0.37\% \quad \text{(compiler)}$$

The heat of solution, ΔH, and the entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = -42.7 \pm 1.26$$
$$\Delta S/\text{J K}^{-1}\ \text{mol}^{-1} = -48.5 \quad \text{(at 523 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Pressure measuring technique.

The diagram of the apparatus, which is a slight modification of the one described earlier (1), is given in the original paper. The melt was evacuated for a long time for degassing. The vacuum was disconnected and water vapors at a known pressure were introduced. The melt was stirred vigorously and the system allowed to come to equilibrium. The number of moles of water dissolved in the melt was calculated from the equilibrium pressure.

SOURCE AND PURITY OF MATERIALS:

Reagent grade sodium acetate and potassium acetate from Carlo Erba (Milan) were used without further purification.

The salt mixture was melted in a N_2 atmosphere, dried with liquid air and molecular sieves and freed from oxygen. N_2 was bubbled through the the melt overnight and then evacuated for several hours. A clear water free melt was obtained

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Zambonin, P. G.; Cardetta, V. L.; Signorile, G.

J. Electroanal. Chem. 1970, 28, 237.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Sodium nitrate; $NaNO_3$; [7631-99-4]
(4) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Duke, F. R.; Doan, Jr., A. S.

Iowa State Coll. J. Sci. 1958, 32, 451 - 53.

VARIABLES: P/kPa = 7.999 (max)
T/K = 418 - 513
melt comp./mol% $LiNO_3$ = 12.5 - 86.9

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water vapors in molten $LiNO_3$ - $NaNO_3$ - KNO_3 mixtures of different compositions and at different temperatures are given as:

Composition of $LiNO_3$ - $NaNO_3$ - KNO_3 Melt/mol%	t/°C	$10^6\ x_1$/ mol(mol of $Li^+)^{-1}$(mm Hg)$^{-1}$
12.5 - 46.4 - 41.1	240	1.02
24.8 - 39.9 - 35.3	240	2.07
30.0 - 37.1 - 32.9	240	2.50
46.7 - 28.2 - 25.1	240	10.0
67.0 - 17.5 - 15.5	240	27.4
86.9 - 6.9 - 6.2	240	49.7
30.0 - 23.0 - 47.0	145	23.8
	170	13.0
	175	8.8
	205	3.2

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

Water vapors at the desired pressure were let into the apparatus above the melt. The fall in the pressure of water vapors, due to its solubility in the melt, was recorded as a function of time till equilibrium was reached. The amount of water dissolved in the melt was calculated from the initial and final values of the pressure.

SOURCE AND PURITY OF MATERIALS:

Not described.

About 10 g of the salt mixture was taken and vacuum dried. The temperature was slowly raised above the melting point and brought to the working temperature. Evacuation of the melt was continued for several hours to ensure complete drying.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Sodium nitrate; $NaNO_3$; [7631-99-4] (4) Potassium nitrate; KNO_3; [7757-79-1]	Duke, F. R.; Doan, Jr., A. S. **Iowa State Coll. J. Sci.** 1958, 32, 451 - 53.
VARIABLES:	PREPARED BY:
	N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

Temperature dependence of x_1 for the solubility of water in molten $LiNO_3$ - $NaNO_3$ - KNO_3 (30 - 23 - 47 mol%) can be expressed by the relation:

$$\log(x_1/\text{mol(mol of Li}^+)^{-1}(\text{mm Hg})^{-1}) = -11.592 + 2932/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 7.5\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, of water in molten $LiNO_3$ - $NaNO_3$ - KNO_3 (30 - 23 - 47 mol%) is:

$$\Delta H/\text{kJ mol}^{-1} = -54.39 \pm 16.7$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]
(4) Sodium nitrate; $NaNO_3$; [7631-99-4]

ORIGINAL MEASUREMENTS:

Tripp, T. B.
J. Electrochem. Soc. 1987, 134, 848 - 855.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 383.15 - 412.77

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of the melt system 0.41 $LiNO_3$ - 0.41 KNO_3 - 0.18 $NaNO_3$ - H_2O were measured at four temperatures as a function of the water mole ratio in the melt.

Values of the Henry's law constant are given below :

T/K	$k_H/kP_a\cdot$mol salt$\cdot$(mol $H_2O)^{-1}$
383.15	34.69
391.91	46.92
402.66	66.87
412.77	91.89

The enthalpy of vaporization of water from the melt was calculated to be 43.1 kJ mol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described earlier(1), was used for vapor pressure measurements.

SOURCE AND PURITY OF MATERIALS:

Reagent grade lithium nitrate was dried at 423K for several days.

$NaNO_3$ and KNO_3, both of reagent grades, were dried at 383K for at least 24h.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J.
J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1] (4) Cesium nitrate; $CsNO_3$; [7789-18-6]	Tripp, T. B. J. Electrochem. Soc. 1987, 134, 848 - 855.
VARIABLES: P/kPa: 101.325 (compiler) T/K = 402.6	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of the melt system $0.41LiNO_3 - 0.41KNO_3 - 0.18CsNO_3 - H_2O$ were measured as a function of the water mole ratio in the melt at 402.66K are as shown in the Fig.

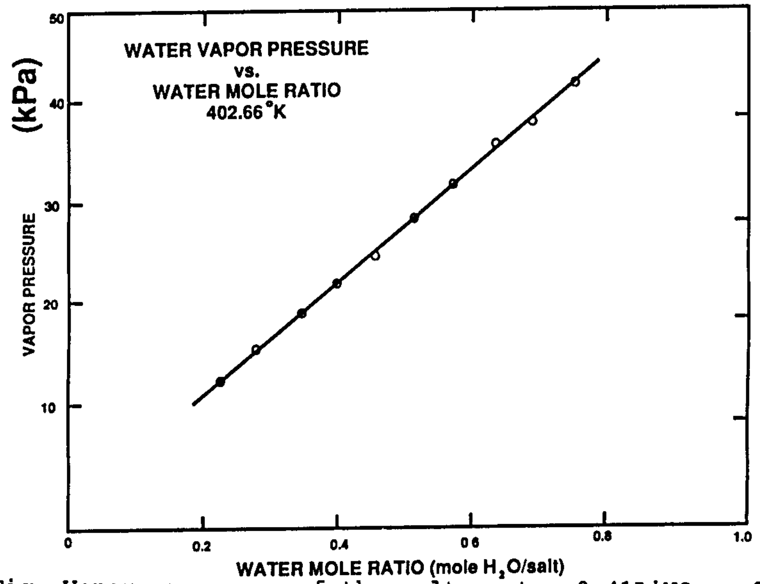


Fig. Vapor pressures of the melt system $0.41LiNO_3 - 0.41KNO_3 - 0.18CsNO_3 - H_2O$ at 402.66K as a function of water mol ratio in the melt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described earlier(1), was used for vapor pressure measurements.

SOURCE AND PURITY OF MATERIALS:

Reagent grade lithium nitrate was dried at 423K for several days.

KNO_3 of reagent grade was dried at 383K for at least 24h.

Reagent grade $CsNO_3$ was used as received except for drying.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J. J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]
(4) Magnesium nitrate; $Mg(NO_3)_2$; [10377-60-3]

ORIGINAL MEASUREMENTS:

Tripp, T. B.
J. Electrochem. Soc. 1987, 134, 848 - 855.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 402.66

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of the melt system $0.472LiNO_3 - 0.472KNO_3 - 0.056Mg(NO_3)_2 - H_2O$ as a function of water mole ratio in the melt at 402.66K are shown in Fig.

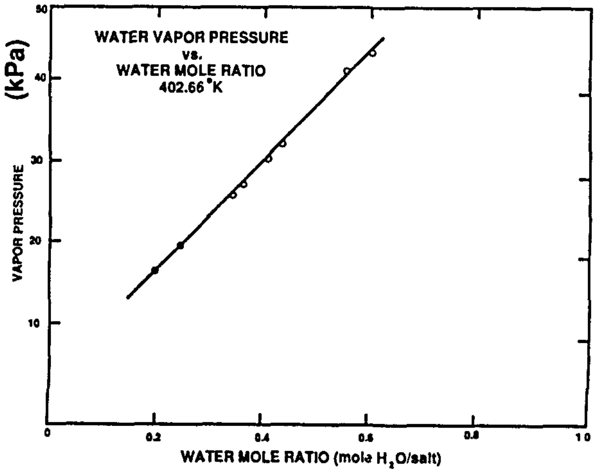


FIG. Vapor pressures of the melt system $0.472LiNO_3 - 0.472KNO_3 - 0.056Mg(NO_3)_2 - H_2O$ at 402.66K as a function of water mole ratio.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described earlier(1), was used for vapor pressure measurements.

SOURCE AND PURITY OF MATERIALS:

Reagent grade lithium nitrate was dried at 423K for several days.

KNO_3 of reagent grade was dried at 383K for at least 24h.

Reagent grade $Mg(NO_3)\cdot 6H_2O$ was dried at 363K for 24h.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J.
J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]
(4) Calcium nitrate; $Ca(NO_3)_2$; [10124-37-5]

ORIGINAL MEASUREMENTS:

Tripp, T. B.
J. Electrochem. Soc. 1987, 134, 848 - 855.

VARIABLES:

P/kPa: 101.325 (compiler)
T/K = 402.66

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of the melt system $0.472LiNO_3 - 0.472KNO_3 - 0.056Ca(NO_3)_2 - H_2O$ as a function of water mole ratio in the melt are presented in Fig.

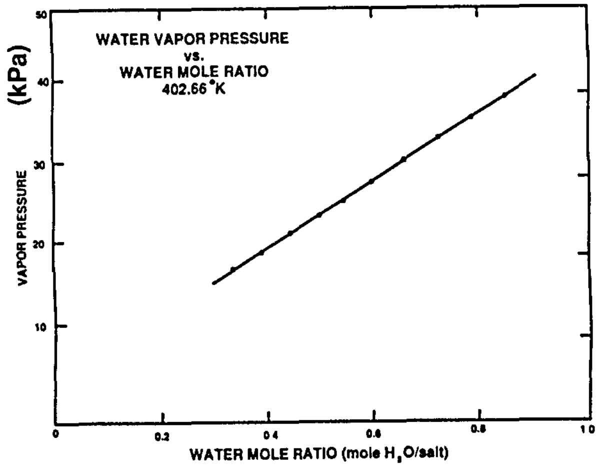


FIG. Vapor pressures of the melt system $0.472LiNO_3 - 0.472KNO_3 - 0.056Ca(NO_3)_2 - H_2O$ at 402.66K as a function of water mole ratio in the melt.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described earlier(1), was used for vapor pressure measurements.

SOURCE AND PURITY OF MATERIALS:

Reagent grade lithium nitrate was dried at 423K for several days.

KNO_3 of reagent grade was dried at 383K for at least 24h.

Reagent grade calcium nitrate tetrahydrate was stored in a desiccator over magnesium perchlorate for several weeks.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J. J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Silver nitrate; $AgNO_3$; [7761-88-8] (3) Thallium nitrate; $TlNO_3$; [10102-45-1] (4) Sodium nitrate; $Na(NO_3)$; [7631-99-4]	Abraham, M. C.; Abraham, M.; Sangster, J. **J. Chem Eng. Data** 1980, 25, 331 - 332.
VARIABLES:	**PREPARED BY:**
T/K = 371.5 P/kPa: 101.325 (compiler)	N. P. Bansal

EXPERIMENTAL VALUES:

In the $AgNO_3$ - $TlNO_3$ - $NaNO_3$ melts, the Ag/Tl mol ratio was fixed at 1.06. Various melt compositions were prepared by adding 0, 2.5, 5.0, 7.5 and 10.1 mol% of $NaNO_3$ to the melt.

Henry's law constant, K_H was calculated from the equation :

$$f = f_w^\circ \, r_w^\alpha \, x_w = K_H x_w$$

Where f is the fugacity of vapor, f_w° is the fugacity of pure water, r_w^α is the activity coefficient of water at infinite dilution in the melt, and x_w is the mole fraction of water in the melt solution.

Values of K_H at 98.5 °C for various melt compositions are given below:

Melt comp*/mol % $NaNO_3$	K_H/atm. mol melt (mol H_2O)$^{-1}$
0	1.25
2.5	1.18
5	1.12
7.5	1.07
10.1	1.02

* Ag/Tl mol ratio = 1.06

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A static method was used for vapor pressure measurements details of which have been described earlier(1).

SOURCE AND PURITY OF MATERIALS:

$NaNO_3$ (Anachemia Reagent) was used without further treatment.

Details of salt mixture preparation has been reported earlier(2).

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Truddelle, M. C.; Abraham, M. Sangster, J. **Can. J. Chem.** 1977, 55, 1713.
2. Abraham, M. C.; Abraham,M.; Sangster, J. **J. Sol. Chem.** 1979, 8, 647.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Silver nitrate; $AgNO_3$; [7761-88-8]
(3) Thallium nitrate; $TlNO_3$; [10102-45-1]
(4) Cadmium nitrate; $Cd(NO_3)_2$; [10325-94-7]

ORIGINAL MEASUREMENTS:

Abraham, M. C.; Abraham, M.; Sangster, J.
Can. J. Chem. 1978, 56, 635 - 637.

VARIABLES:

T/K = 371.5

P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law constant, K_H was calculated from the equation :

$$f = f_w^\circ \, r_w^\alpha \, x_w = K_H x_w$$

Where f is the fugacity of vapor, f_w° is the fugacity of pure water at temperature, r_w^α is the activity coefficient of water at infinite dilution in the melt, and x_w is the mole fraction of water in the melt solution.

Values of K_H at 98.5 °C for various melt compositions are given below:

Melt comp*/mol % $Cd(NO_3)_2$	K_H/atm. mol melt (mol $H_2O)^{-1}$
0	1.25
5	0.770
7.5	0.662
10	0.514
12.5	0.442

* Ag/Tl mol ratio = 1.06

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A static technique was used for vapor pressure measurements details of which have been described earlier(1).

In the melt, Ag/Tl mole ratio was fixed at 1.06 and the mole fractions of Cd, Cd/(Ag+Tl+Cd), of Cd in the melt were varied 0, 0.05, 0.075, 0.10, and 0.125 by adding cadmium nitrate.

SOURCE AND PURITY OF MATERIALS:

$Cd(NO_3)_2 \cdot 4H_2O$ (Fisher, 99.9%) was used.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Truddelle, M. C.; Abraham, M. Sangster, J.
Can. J. Chem. 1977, 55, 1713.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Silver nitrate; $AgNO_3$; [7761-88-8]
(3) Thallium nitrate; $TlNO_3$; [10102-45-1]
(4) Cesium nitrate; $CsNO_3$; [7789-18-6]

ORIGINAL MEASUREMENTS:

Abraham, M. C.; Abraham, M.; Sangster, J.
J. Sol Chem. 1979, 8, 647 - 654.

VARIABLES:

T/K = 371.5
P/kPa: 101.325 (compiler)

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law constant, K_H was calculated from the equation :

$$f = f_w{}^{\circ}\ r_w{}^{\alpha}\ x_w = K_H x_w$$

Where f is the fugacity of vapor, $f_w{}^{\circ}$ is the fugacity of pure water $r_w{}^{\alpha}$ is the activity coefficient of water at infinite dilution in the melt, and x_w is the mole fraction of water in the melt solution.

Value of K_H at 98.5 °C for various melt compositions are given below:

Melt comp*/mol % $CsNO_3$	K_H/atm. mol melt (mol H_2O)$^{-1}$
0	1.25
2.45	1.28
5	1.30
7.5	1.33
10	1.36

* Ag/Tl mol ratio = 1.06

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A static technique was used for vapor pressure measurements details of which have been described earlier(1).

In the melt, Ag/Tl mole ratio was fixed at 1.06 and the mole fractions of Cs, Cs/(Ag+Tl+Cs), in the melt were 0, 2.45, 5, 7.5, and 10.

The salt mixture was prepared by weighing and dried at 200°C in vacuo. The melt was filtered through sintered glass, and stored in a closed vessel in an air oven at 120 °C.

SOURCE AND PURITY OF MATERIALS:

$AgNO_3$ (99.99% Macco or 99.98% Engelhard was used without further treatment.

$TlNO_3$ (Alfa) was recrystallized from water and dried at 120°C.

$CsNO_3$ (99.9% K&K Laboratories) was used as received.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Truddelle, M. C.; Abraham, M. Sangster, J.
Can. J. Chem. 1977, 55, 1713.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrite; KNO_2; [7758-09-0]
(4) Sodium nitrite; $NaNO_2$; [7632-00-0]

ORIGINAL MEASUREMENTS:

Tripp, T. B.
Proc. Electrochem. Soc. 1984, **84**, 403 - 410.

VARIABLES: P/kPa: 101.325 (compiler)

T/K = 383.00 - 422.51

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The Henry's law constant, k_H, was calculated from :

$$k_H = p_{H_2O}/R_H$$

Where p_{H_2O} is the vapor pressure(torr) of water in the gas phase, R_H is the water mole ratio in the melt. Values of k_H for the solubility of water in $0.52LiNO_3 - 0.17KNO_2 - 0.31NaNO_2$ melt at various temperatures are given below :

t/°C	k_H/torr(mol of water)$^{-1}$·mole of cation
110.00	212.8
118.76	292.5
129.51	408.9
139.61	578.2
149.51	761.3

From the temperature dependence of k_H, the enthalpy of vaporization of water from the melt was calculated to be 10.4 kcal/mol

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, the details of which have been described previously(1,2).

SOURCE AND PURITY OF MATERIALS:

$LiNO_3$(Alfa Products Co.) was dried for 24h. at 150°C.

KNO_2 and $NaNO_2$ both from Alfa Products Co. were dried at 850°C for a minimum of 48h.

ESTIMATED ERROR:

Uncertainty in p_{H_2O} = ± 1 torr.

REFERENCES:

1. Tripp, T. B.; Braunstein, J. **J. Phys. Chem.** 1969, 73, 1984.
2. Tripp, T. B. in **"Molten Salts"**, The Electrochem Soc., 1976, p. 560.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrite; KNO_2; [7758-09-0] (4) Sodium nitrite; $NaNO_2$; [7632-00-0]	Tripp, T. B. **J. Electrochem. Soc.** 1987, 134, 848 - 855.
VARIABLES: P/kPa: 101.325 (compiler) T/K = 383.15 - 422.66	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

Vapor pressures of the melt system $0.52LiNO_3-0.31KNO_2-0.17NaNO_2-H_2O$ were measured at five temperatures as a function of water mole ratio.

Values of the Henry's law constant k_H at various temperatures are given below :

T/K	k_H/kPa·mol salt·(mol H_2O)$^{-1}$
383.15	28.06
391.91	38.56
402.66	54.00
412.77	76.45
422.66	100.60

The enthalpy of vaporization of water from the melt was calculated to be 43.5 kJ mol^{-1}.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A differential transpiration method, details of which have been described earlier(1), was used for vapor pressure measurements.

SOURCE AND PURITY OF MATERIALS:

Reagent grade lithium nitrate was dried at 423K for several days.

Reagent grade KNO_2 was dried overnight at 363K, pulverized, and and redried at 373K.

$NaNO_2$, reagent grade, was dried at 383K for at least 24h.

ESTIMATED ERROR:

Not specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J. **J. Phys. Chem.** 1969, 73, 1984.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium nitrate; $NaNO_3$; [7631-99-4] (3) Potassium nitrate; KNO_3; [7757-79-1] (4) Potassium chloride; KCl; [7447-40-7]	Haug, H.; Albright, L. F. **Ind. Eng. Chem. Proc. Des. Dev.** 1965, 4, 241 - 49.
VARIABLES:	PREPARED BY:
T/K = 489 & 523 mol% Cl^- in the melt = 2 - 5 P/kPa: 101.325 (1 atm.)	N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of water vapor at 1 atm. pressure in the molten mixture $NaNO_3$ - KNO_3 (54.3 - 45.7 mol%) containing various concentrations of Cl^- ions (2 - 5 mol%) have been reported in a graphical form. The values derived from the graph, by the compiler, are:

T/K	conc. of Cl^- in the melt/mol%	10^2 x_1/mol fraction atm^{-1}	10^5 x_1/mol fraction $torr^{-1}$
523	2.0	5.0	6.6
489	5.0	8.5	11.2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Stripping method. The melt was saturated with steam at a particular pressure. The steam dissolved in the melt was stripped with a stream of nitrogen and absorbed in tubes containing concentrated H_2SO_4.	Not described. ESTIMATED ERROR: solubility: ± 2% (authors) REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Deuterium oxide; D_2O; [11105-15-0] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Tripp, T. B. J. Chem. Thermodyn. 1975, 7, 263 - 69.
VARIABLES:	**PREPARED BY:**
T/K = 383 - 422 P/kPa: 101.325 (compiler)	N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed for the solubility of D_2O. The solubilities of D_2O in molten $LiNO_3$ - KNO_3 (50 - 50 mol%) mixture at different temperatures are:

T/K	10^4 x_1/mol fraction torr^{-1}
383.15	41.9
391.91	30.5
402.66	21.4
412.76	15.4
422.66	11.4

Smoothed Data:

The temperature dependence of x_1 can be expressed by the equation:

$$\log(x_1/\text{mol fraction torr}^{-1}) = -8.414 + 2311.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.2% (compiler)

The enthalpy of solution, ΔH, is:

$$\Delta H/\text{kJ mol}^{-1} = -44.4 \pm 0.4$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Vapor pressure measurements.

The solubilities of D_2O have been indirectly derived from vapor pressure measurements of the $LiNO_3$ - KNO_3 - D_2O system using a differential transpiration method described elsewhere (1).

SOURCE AND PURITY OF MATERIALS:

Lithium and potassium nitrates, Mallinckrodt AR grade, were dried at 520 K. D_2O (99.9 mol%) was provided by Oak Ridge National Lab.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Tripp, T. B.; Braunstein, J.

J. Phys. Chem. 1969, 73, 1984.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Hydrogen sulfide; H_2S; [7783-06-4] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Allulli, S. **J. Phys. Chem.** 1969, 73, 1084 - 87.
VARIABLES:	PREPARED BY:
one temperature: T/K = 433	N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of H_2S in molten $LiNO_3$ - KNO_3 eutectic at 160°C was too small ($<10^{-7}$ mol(mol of melt)$^{-1}$ torr^{-1}) to be measured with the experimental method employed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

SOURCE AND PURITY OF MATERIALS:

H_2S (98%) from Rivoira was used without further purification.

$LiNO_3$ (ERBA RP) was dehydrated at 70°C to avoid hydrolysis. KNO_3 (ERBA RP) was finely powdered and vacuum dried at 110°C for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Lithium nitrate; $LiNO_3$; [7790-69-4]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Two independent studies (1,2) have been reported for the solubility of ammonia in molten lithium nitrate. Results from the two investigations, compared below in Fig. 1, are seen to be quite different. Tentative solubilities based on ref. (2) are given in Table 1. Further Studies are needed to evaluate this system.

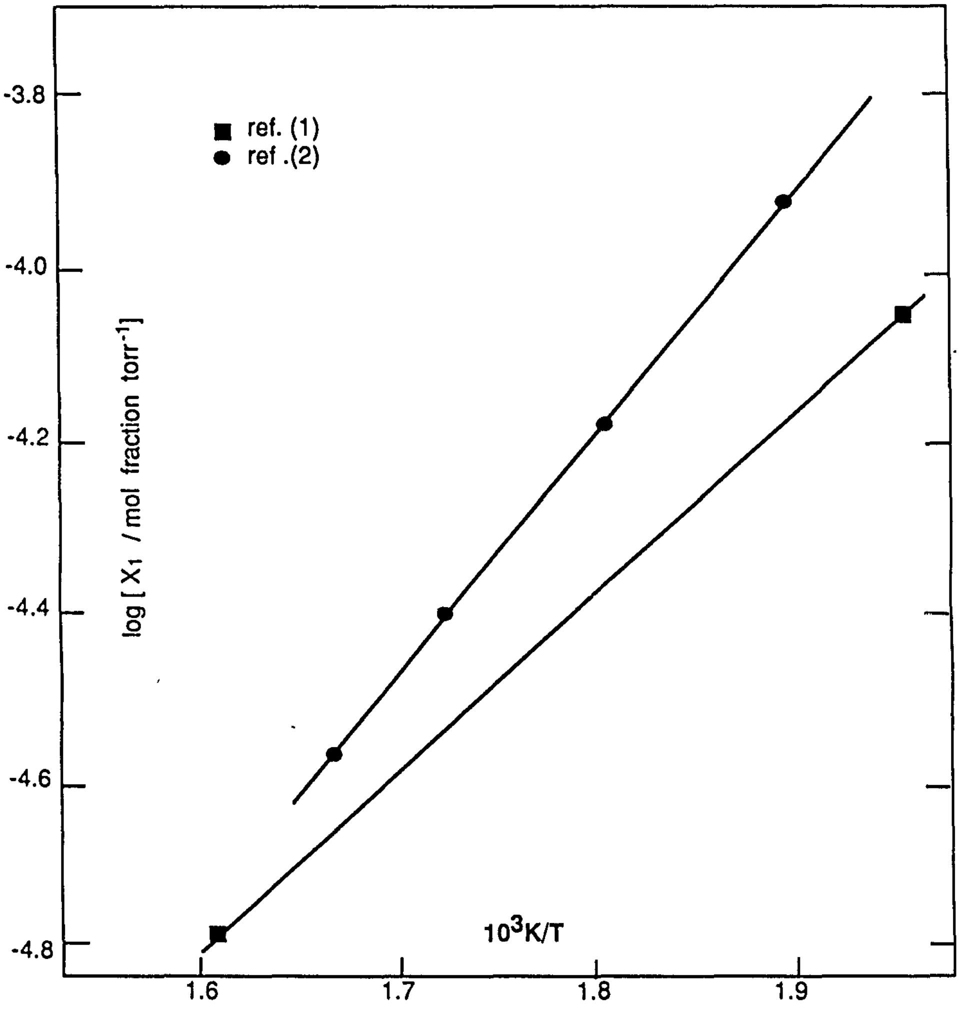


Fig. 1

COMPONENTS:	EVALUATOR:
(1) Ammonia; NH_3; [7664-41-7] (2) Lithium nitrate; $LiNO_3$; [7790-69-4]	N. P. Bansal National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio, 44135. U.S.A. December, 1989.

CRITICAL EVALUATION:

Table 1

Tentative Solubilities as a Function of Temperature

T/K	10^6 K_H/mol cm^{-3} $torr^{-1}$	10^5 x_1/mol fraction $torr^{-1}$
530	(3.6)	(13.8)
540	2.7	10.5
550	2.1	8.0
560	1.6	6.2
570	1.2	4.8
580	0.96	3.8
590	(0.76)	(3.0)

Values in ( ) outside temperature interval of experimental measurement; extrapolated by the evaluator.

References:

1. Paniccia, F.; Zambonin, P. G. J. **Chem. Soc. Faraday Trans.** I 1973, **69**, 2019.

2. Allulli, S. J. **Phys. Chem.** 1969, 73, 1084.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, 69, 2019 - 25.

VARIABLES:

T/K = 523 & 623

P/kPa = 10 - 40

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of ammonia were measured in molten $LiNO_3$ - KNO_3 mixtures of various compositions. A linear relationship was observed between the logarithm of x_1 and the melt compositions. The extrapolated values of x_1 in pure molten $LiNO_3$ at two temperatures are:

T/K	10^2 x_1/mol fraction bar^{-1}
523	6.6
623	1.2

Smoothed Data:

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are reported to be:

$\Delta H/kJ\ mol^{-1} = -55.0$

$\Delta S°/J\ K^{-1}\ mol^{-1} = -65.0$ (at 623 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Extrapolated from the solubility data of ammonia in lithium nitrate - potassium nitrate mixtures. Gas solubilities in the mixed nitrates were measured by the manometric technique (1,2).

SOURCE AND PURITY OF MATERIALS:

Anhydrous ammonia (Matheson) was used without further treatment.

Reagent grade lithium nitrate (Carlo Erba, Milan) was used without further purification.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Electroanal. Chem. 1972, 38, 373.
2. Zambonin, P. G.; Cardetta, V. L.; Signorile, G.
J. Electroanal. Chem. 1970, 28, 237.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Lithium nitrate; $LiNO_3$; [7790-69-4]

ORIGINAL MEASUREMENTS:

Allulli, S.

J. Phys. Chem. 1969, 73, 1084 - 87.

VARIABLES:

$T/K = 533 - 588$

$P/kPa = 0.667 - 6.666$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of ammonia in molten $LiNO_3$ obeyed Henry's law. The values of Henry's law constant, K_H at different temperatures are:

t/°C	10^5 x_1/mol fraction mm^{-1}	10^6 K_H^a/mol cm^{-3} mm^{-1}
260	12.5	3.22
283	7.05	1.80
303	4.1	1.04
315	3.1	0.79

[a] Values calculated by the compiler using density data from: Janz, G. J., **Molten Salts Handbook**, Academic Press, New York, 1967, 42.

Smoothed Data:

The temperature dependences of K_H and x_1 are given by the expressions:

$$\log(K_H/\text{mol cm}^{-3}\text{ mm}^{-1}) = -12.08 + 3516/(T/K) \quad \text{(compiler)}$$

$$\log(x_1/\text{mol fraction mm}^{-1}) = -10.41 + 3472/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.2\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = -69.04$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = -127.2 \quad \text{(at 543 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The details of the procedure employed for solubility measurements have been given in the original paper. In brief, ammonia was let into the system above the melt to the desired pressure. The drop in gas pressure due to its solubility in the melt was recorded as a function of time till a stable equilibrium pressure was attained. The number of moles of the gas dissolved in the melt was calculated.

SOURCE AND PURITY OF MATERIALS:

Ammonia supplied by Matheson Co. was used without further purification. Its purity, checked by mass spectroscopy, was better than 99.5%.

$LiNO_3$ (ERBA RP) was dehydrated at 70°C to avoid hydrolysis.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Ammonia; NH_3; [7664-41-7] (2) Sodium nitrate; $NaNO_3$; [7631-99-4]	Paniccia, F.; Zambonin, P. G. **J. Chem. Soc. Faraday Trans. I** 1973, 69, 2019 - 25.
VARIABLES: T/K = 588 - 653 P/kPa = 10 - 40	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of ammonia in molten sodium nitrate as a function of temperature are presented in graphical form in the original paper. The values of x_1 derived from this graph by the compiler are:

T/K	10^4 x_1/mol fraction bar^{-1}
588	14.1
591	13.4
612	11.6
624	10.9
637	9.5
653	8.5

Smoothed Data:

Temperature dependence of x_1 may be expressed by the equation:

$$\log(x_1/\text{mol fraction bar}^{-1}) = -4.988 + 1254.3/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.9\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$\Delta H/kJ\ mol^{-1} = -23.0$ $\Delta S°/J\ K^{-1}\ mol^{-1} = -34.0$ (at 623 K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The experimental details have been described elsewhere (1,2). In brief, the apparatus was evacuated and then ammonia gas was introduced into the system at about one bar pressure. The initial gas pressure was immediately noted. The melt was vigorously stirred and the fall in gas pressure due to its solubility in the melt was continuously recorded till equilibrium was attained. The final gas pressure was noted and the Henry's law constant was evaluated.

SOURCE AND PURITY OF MATERIALS:

Anhydrous ammonia (Matheson) was used without further treatment.

Reagent grade sodium nitrate (Carlo Erba, Milan) was used as received.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Electroanal. Chem. 1972, 38, 373.
2. Zambonin, P. G.; Cardette, V. L.; Signorile, G.
J. Electroanal. Chem. 1970, 28, 237.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]

(2) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, 69, 2019 - 25.

VARIABLES:

T/K = 619 - 680

P/kPa = 10 - 40

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of ammonia in molten potassium nitrate as a function of temperature are presented in graphical form in the original publication. The values of x_1 derived from this graph by the compiler are:

T/K	10^4 x_1/mol fraction bar^{-1}
619	5.9
625	5.6
640	5.2
654	5.3
673	4.9

Smoothed Data:

Temperature dependence of x_1 could be given by the expression:

$$\log(x_1/\text{mol fraction bar}^{-1}) = -4.117 + 542.9/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.3% (compiler)

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kJ mol}^{-1} = -11.0$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -23.0 \quad \text{(at 623 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The details of the experimental procedure are given elsewhere (1,2). In brief, the apparatus was evacuated and then ammonia gas was introduced into the system at about one bar pressure. The initial gas pressure was quickly noted. The melt was vigorously stirred and the fall in gas pressure due to its dissolution in the melt was continuously recorded until equilibrium was attained. The final gas pressure was noted and Henry's law constant was computed.

SOURCE AND PURITY OF MATERIALS:

Anhydrous ammonia (Matheson) was used without further treatment.

Reagent-grade potassium nitrate (Carlo Erba, Milan) was used without further purification.

ESTIMATED ERROR:

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Electroanal. Chem. 1972, 38, 373.
2. Zambonin, P. G.; Cardette, V. L.; Signorile, G.
J. Electroanal. Chem. Chem. 1970, 28, 237

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, **69**, 2019 - 25.

VARIABLES:

T/K = 475 - 560
P/kPa = 10 - 40

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of ammonia in the molten $LiNO_3$ - KNO_3 (50 - 50, 66.67 - 33.33, 85-15 mol%) mixtures as a function of temperature are presented in graphical form in the original paper. The values of x_1 derived from this graph by the compiler are:

Melt Composition/ mol% $LiNO_3$	T/K	10^3 x_1/ mol fraction bar^{-1}
50.0	475	18.7
	488	15.5
	522	9.2
	527	8.5
	530	8.2
	539	7.2
66.67	495	26.0
	496	27.9
	515	18.9
	517	18.9
	529	15.5 ± 0.6
85.0	522	30.8
	534	23.9
	543	21.1
	547	19.6 ± 0.7
	554	17.1
	558	16.1
	560	15.4

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The experimental procedure has been described in detail elsewhere (1,2). Briefly, the apparatus was evacuated and then ammonia gas was introduced into the system at about one bar pressure. The initial gas pressure was quickly noted. The melt was vigorously stirred and the fall in gas pressure due to its solubility in the melt was continuously recorded until equilibrium was reached. The final gas pressure was noted and the Henry's law constant was evaluated.

SOURCE AND PURITY OF MATERIALS:

Anhydrous ammonia (Matheson) was used without further treatment.

Reagent-grade lithium and potassium nitrates (Carlo Erba, Milan) were used as received.

The melt container was made of Teflon.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Electroanal. Chem. 1972, **38**, 373.
2. Zambonin, P. G.; Cardette, V. L.; Signorile, G.
J. Electroanal. Chem. 1970, **28**, 237.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, **69**, 2019 - 25.

VARIABLES:

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

The temperature dependence of x_1 could be expressed by equations of the form:

$$\log(x_1/\text{mol faction bar}^{-1}) = a + b/(T/K)$$

The values of the coefficients a and b of the above equation for various molten salts mixtures, along with the enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

Melt Composition/ mol% $LiNO_3$	a	b	std. dev.	ΔH/ kJ mol^{-1}	$\Delta S°$/J K^{-1} mol^{-1} (at 623 K)
50.0	-5.232	1667.3	0.5%	-31.9	-43.0
66.67	-5.354	1874.6	1.7%	-35.9	-47.0
85.0	-5.869	2273.0	0.6%	-43.5	-53.0

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Allulli, S.

J. Phys. Chem.. 1969, 73, 1084 - 87.

VARIABLES:

melt comp./mol% $LiNO_3$:= 43 and 75
P/kPa = 0.667 - 6.666
T/K = 433 -598

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of ammonia in the molten mixtures $LiNO_3$ - KNO_3 (43 - 57, 75 - 25 mol%) obeyed Henry's law. The solubility values at various temperatures are:

Melt Composition/ mol% $LiNO_3$	t/°C	10^5 x_1/ mol fraction mm^{-1}
43	160	4.1
	190	2.45
	210	1.7
	250	1.05
75	242	4.2
	275	2.05
	292	1.5
	325	0.85

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

The details of the procedure employed for solubility measurements are given in the original paper. Briefly, ammonia was let into the system above the melt to the desired pressure. The fall in gas pressure due to its solubility in the melt was noted as a function of time until a stable equilibrium pressure was attained. The number of moles of the gas dissolved in the melt was calculated.

SOURCE AND PURITY OF MATERIALS:

Ammonia supplied by Matheson Co. was used without further purification. Its purity, checked by mass spectrometry, was better than 99.5%

KNO_3 (ERBA RP) was finely powdered and vacuum dried at 110°C for 24 hr. $LiNO_3$ was dehydrated at 70°C to avoid hydrolysis.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Ammonia; NH_3; [7664-41-7] (2) Lithium nitrate; $LiNO_3$; [7790-69-4] (3) Potassium nitrate; KNO_3; [7757-79-1]	Allulli, S. J. Phys. Chem. 1969, 73, 1084 - 87.
VARIABLES:	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES:

continued

Smoothed Data:

The temperature dependence of x_1 is given by the relations:

$LiNO_3$ - KNO_3 (43 - 57 mol%)

$$\log(x_1/\text{mol fraction mm}^{-1}) = -7.86 + 1501.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.6% (compiler)

$LiNO_3$ - KNO_3 (75 - 25 mol%)

$$\log(x_1/\text{mol fraction mm}^{-1}) = -9.37 + 2571.7/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.63% (compiler)

The enthalpies of solution, ΔH, and entropies of solution, ΔS, are:

Melt Composition/ mol% $LiNO_3$	ΔH/kJ mol^{-1}	ΔS/J K^{-1} mol^{-1} (at 523 K)
43	-29.29	-56.07
75	-49.37	-95.40

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1973, **69**, 2019 - 25.

VARIABLES: T/K = 538 - 585
P/kPa = 10 - 40

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities of ammonia in the molten equimolar $NaNO_3$ - KNO_3 mixture are reported in graphical form in the original paper. The values of x_1 at different temperatures, derived from this graph by the compiler, are:

Melt Composition/ mol% $NaNO_3$	T/K	10^4 x_1/ mol fraction bar^{-1}
50.0	538	14.6
	565	11.5 ± 0.7
	585	10.3 ± 0.6

Smoothed Data:

Temperature dependence of x_1 is expressed by the relation:

$$\log(x_1/\text{mol fraction bar}^{-1}) = -4.744 + 1025.0/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.1\% \quad \text{(compiler)}$$

The enthalpy of solution, ΔH, and the standard entropy of solution, $\Delta S°$, are:

$$\Delta H/\text{kJ mol}^{-1} = -18.0$$

$$\Delta S°/\text{J K}^{-1}\text{ mol}^{-1} = -30.0 \quad \text{(at 623 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.

Details of the experimental technique are given elsewhere (1,2). In brief, the apparatus was evacuated and then ammonia gas was introduced into the system at about one bar pressure. The initial gas pressure was quickly noted. The melt was vigorously stirred and the fall in gas pressure due to its solubility in the melt was continuously recorded until equilibrium was attained. The final gas pressure was noted and Henry's constant was calculated.

SOURCE AND PURITY OF MATERIALS:

Anhydrous ammonia (Matheson) was used without further treatment.

Reagent-grade sodium and potassium nitrates (Carlo Erba, Milan) were used as received.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.
J. Electroanal. Chem. 1972, **38**, 373.
2. Zambonin, P. G.; Cardette, V. L.; Signorile, G.
J. Electroanal. Chem. 1970, **28**, 237.

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]
(2) Lithium perchlorate; $LiClO_4$; [7791-03-9]
(3) Potassium perchlorate; $KClO_4$; [7778-74-7]

ORIGINAL MEASUREMENTS:

Allulli, S.

J. Phys. Chem. 1969, 73, 1084 - 87.

VARIABLES: $T/K = 507 - 583$
$P/kPa = 0.667 - 6.666$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of ammonia in the molten mixture $LiClO_4$ - $KClO_4$ (76 - 24 mol%) obeyed Henry's law. The values of solubility and Henry's law constant at different temperatures are:

t/°C	10^5 x_1/mol fraction mm^{-1} [a]	10^6 K_H/mol cm^{-3} mm^{-1}
234	128	23.56
251	84	15.46
266	61.5	11.32
288	37	6.81
311	23	4.23

[a] Values calculated by the compiler using appropriate value of density as 2.1 g ml^{-1} at 523 K from Allulli, S.; **J. Phys. Chem.** 1969, **73**, 1084.

Smoothed Data:

The temperature dependences of K_H and x_1 are expressed by the relations:

$$\log(K_H/\text{mol cm}^{-3}\text{ mm}^{-1}) = -10.27 + 2862.6/(T/K) \quad \text{(compiler)}$$

$$\log(x_1/\text{mol fraction mm}^{-1}) = -8.53 + 2862.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.1% (compiler)

The enthalpy of solution, ΔH, and the entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = -57.74$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = -110.46 \quad \text{(at 523 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The details of the procedure used for solubility measurements have been described in the original publication. In brief, ammonia was let into the system above the melt to the desired pressure. The fall in gas pressure due to its solubility in the melt was noted with time until a stable equilibrium value was reached. The number of moles of the gas dissolved in the melt was calculated.

SOURCE AND PURITY OF MATERIALS:

Ammonia supplied by Matheson Co. was used without further purification. Its purity, checked by mass spectrometry, was better than 99.5%.

$KClO_4$ (ERBA RP) was dried under vacuum at 110°C for 24 hr. $LiClO_4$ (RUDI PONT) was dehydrated at 70°C to avoid hydrolysis.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Ammonia; NH_3; [7664-41-7]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Sodium nitrate; $NaNO_3$; [7631-99-4]
(4) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Allulli, S.

J. Phys. Chem. 1969, 73, 1084 - 87.

VARIABLES:

T/K = 433 - 523
P/kPa = 0.667 - 6.666

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of ammonia in molten $LiNO_3$ - $NaNO_3$ - KNO_3 (27 - 18 - 55 mol%) obeyed Henry's law. The solubilities at different temperatures are:

t/°C	10^5 x_1/mol fraction mm^{-1}
160	2.1
185	1.5
202	1.15
250	0.7

Smoothed Data:

The temperature dependence of solubility , x_1, is given by the relation:

$$\log(x_1/\text{mol fraction mm}^{-1}) = -7.47 + 1208.4/(T/K) \quad \text{(compiler)}$$

std. dev. = 1.2% (compiler)

The enthalpy of solution, ΔH, and entropy of solution, ΔS, are:

$$\Delta H/\text{kJ mol}^{-1} = -24.27$$

$$\Delta S/\text{J K}^{-1}\text{ mol}^{-1} = -46.44 \quad \text{(at 523 K)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric method.
The details of the procedure employed for solubility measurements have been given in the original paper. In brief, ammonia was let into the system above the melt to the desired pressure. The fall in gas pressure due to its solubility in the melt was noted with time until a stable equilibrium value was reached. The number of moles of the gas dissolved in the melt was calculated.

SOURCE AND PURITY OF MATERIALS:

Ammonia supplied by Matheson Co. was used without further purification. Its purity, checked by mass spectrometry, was better than 99.5%.
$NaNO_3$ and KNO_3 both from ERBA RP were vacuum dried at 110°C for 24 hr. $LiNO_3$ (ERBA RP) was dehydrated at 70°C to avoid hydrolysis.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Silicon tetrachloride; $SiCl_4$; [10026-04-7]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;

Russ. J. Inorg. Chem. (Eng. Transl.) 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 1093 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $SiCl_4$ in molten NaCl at different temperatures are reported to be:

t/°C	C_1/mass%	$10^3\ x_1^a$/mol fraction
820	0.37	1.27
850	0.31	1.07
880	0.23	0.79
900	0.16	0.55

[a] Calculated by the compiler.
Pressure of $SiCl_4$ was the vapor pressure of liquid $SiCl_4$ at 160°C.

Smoothed Data:

Temperature dependence of C_1 is expressed by the relation:

$$\log(C_1/\text{mass\%}) = -5.583 + 5661.9/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 4.8\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.
Vapors of silicon tetrachloride were passed through the molten NaCl, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the tetrachloride within 2 - 3 min. The saturated melt was solidified and analyzed for silicon by the gravimetric sulfate method.

SOURCE AND PURITY OF MATERIALS:

Silicon tetrachloride was of 99% purity.
Sodium chloride was of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Silicon tetrachloride; $SiCl_4$; [10026-04-7]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;
Russ. J. Inorg. Chem. (Eng. Transl.) 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 1123 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $SiCl_4$ in molten KCl at different temperatures are reported to be:

t/°C	C_1/mass%	$10^3\ x_1{}^a$/mol fraction
850	0.95	4.16
880	0.80	3.51
900	0.67	2.94

[a] Calculated by the compiler.
Pressure of $SiCl_4$ was the vapor pressure of liquid $SiCl_4$ at 160°C.

Smoothed Data:

Temperature dependence of C_1 is expressed by the relation:

$$\log(C_1/\text{mass\%}) = -3.52 + 3933.7/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.5\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.

Vapors of silicon tetrachloride were passed through the molten KCl, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the tetrachloride within 2 - 3 min. The saturated melt was solidified and analyzed for silicon by the gravimetric sulfate method.

SOURCE AND PURITY OF MATERIALS:

Silicon tetrachloride was of 99.99% purity.

Potassium chloride was of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Silicon tetrachloride; $SiCl_4$; [10026-04-7]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;
Russ. J. Inorg. Chem. (Eng. Transl.) 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 973 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $SiCl_4$ in molten NaCl - KCl (50 - 50 mol%) mixture at different temperatures are reported to be:

t/°C	C_1/mass%	$10^3\ x_1{}^a$/mol fraction
700	0.56	2.19
750	0.54	2.11
800	0.53	2.07
820	0.53	2.07
850	0.52	2.03
880	0.51	1.99
900	0.51	1.99

[a] Calculated by the compiler.
Pressure of $SiCl_4$ was the vapor pressure of liquid $SiCl_4$ at 160°C.

Smoothed Data:
Temperature dependence of C_1 is expressed by the equation:

$$\log(C_1/\text{mass\%}) = -0.489 + 229.2/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.3\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.

Vapors of silicon tetrachloride were passed through the molten NaCl - KCl mixture, kept at a constant temperature, for 10 - 15 min. The melt became saturated with the tetrachloride within 2 - 3 min. The saturated melt was solidified and analyzed for silicon by the gravimetric sulfate method.

SOURCE AND PURITY OF MATERIALS:

Silicon tetrachloride was of 99.99% purity.

Sodium and potassium chlorides were of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;

Russ. J. Inorg. Chem. (Eng. Transl.) 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 1093 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $TiCl_4$ in molten NaCl at different temperatures are reported to be:

t/°C	C_1/mass%	10^3 x_1^a/mol fraction
820	1.20	3.70
850	0.89	2.74
880	0.52	1.60
900	0.38	1.17

[a] Calculated by the compiler.
Pressure of $TiCl_4$ was the vapor pressure of liquid $TiCl_4$ at 160°C.

Smoothed Data:

Temperature dependence of C_1 is given by the relation:

$$\log(C_1/\text{mass\%}) = -7.366 - 8167.5/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 3.8\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.
Vapors of titanium tetrachloride were passed through the molten NaCl, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the tetrachloride within 2 - 3 min. The saturated melt was solidified and titanium was determined volumetrically.

SOURCE AND PURITY OF MATERIALS:

Titanium tetrachloride was of 99.99% purity.
Sodium chloride was of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

1. Maksimov, V. S.; Smirnov, M. V.

Electrochem. Molten Solid Electrolytes 1968, 6, 30 - 36.

continued

VARIABLES:

T/K = 1089 - 1224

P/kPa = 17.124 - 54.412

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed upto P_{TiCl_4} = 0.54 atm. Values of solubility (x_1) and the constant k (= x_1/p) at various temperatures are given as:

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
1089	0.296	22	74
1089	0.537	30	56
1089	0.537	35	65
1092	0.498	32	64
1097	0.470	32	68
1099	0.456	25	55
1099	0.456	30	66
1114	0.409	26	64
1129	0.266	16	60
1139	0.169	11	65
1139	0.298	15	50
1139	0.298	17	57
1139	0.353	18	51
1139	0.353	22	62
1139	0.470	25	53
1139	0.470	28	60
1159	0.316	16	51
1159	0.316	20	63
1176	0.296	20	68
1176	0.470	25	53

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

Method used for solubility measurements has been described earlier (1). A known amount of the melt, at a constant temperature, was kept in contact with the vapor phase consisting of a mixture of argon and titanium tetrachloride for about 8 hr. The partial pressure of titanium tetrachloride, at a fixed temperature, was calculated from an equation (2). The saturated melt was solidified and analyzed for titanium using a calorimetric method.

SOURCE AND PURITY OF MATERIALS:

Not given

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Smirnov, M. V.; Maksimov, V. S.

Electrochem. Molten Solid Electrolytes 1967, 5, 33.

continued

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

continued

2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P.
Zh. Neorg. Khim. 1966, 11, 1765 - **Russ. J. Inorg. Chem.** (Eng. Transl.) 1966, 11, 945 - 48. (*).

VARIABLES:

T/K = 1089 - 1224

P/kPa = 17.124 - 54.412

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: continued.

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
1176	0.470	27	57
1194	0.409	22	54
1209	0.266	14	53
1209	0.266	16	60
1209	0.298	17	57
1224	0.296	17	57

Smoothed Data:

Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -2.73 + 580/(T/K) \pm 0.04$$

The solubility of $TiCl_4$ as a function of temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(p/\text{atm}) - 2.73 + 580/(T/K) \pm 0.04$$

The enthalpy of solution is:

$$\Delta H/\text{kJ mol}^{-1} = -11.3$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

continued

2. Pike, F. P.; Foster, C. T.
J. Chem. Eng. Data 1959, **4**, 305.

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

1. Smirnov, M. V.; Maksimov, V. S. **Elektrokhim.** 1965, 1, 727 - 30; **Sov. Electrochem.** (Eng. Transl.) 1965, 1, 645 - 48. (*).

continued

VARIABLES:

T/K = 1096 - 1213
P/kPa = 34.248 - 65.456

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed up to $P_{TiCl} = 0.7$ atm. Values of solubility (x_1) and the constant k (= x_1/P) at^{4}various temperatures are given as:

T/K	P/atm	10^3 x_1/mol fraction	10^3 k/mol fraction atm^{-1}
1096	0.338	30	90
1096	0.338	34	99
1096	0.479	44	92
1096	0.479	44	92
1096	0.479	46	96
1096	0.479	47	98
1096	0.646	60	93
1114	0.338	29	85
1114	0.479	42	88
1114	0.479	43	90
1114	0.479	43	90
1114	0.646	54	84
1135	0.338	26	77
1135	0.338	27	79
1135	0.338	28	84
1135	0.479	36	76
1135	0.479	38	80
1135	0.646	50	78
1135	0.646	51	79

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

A known amount of the melt was kept in contact with argon containing vapors of titanium tetrachloride with a specific partial pressure. It was allowed to come to equilibrium for at least 10 hr. The saturated melt was solidified and analyzed for titanium.

SOURCE AND PURITY OF MATERIALS:

Pure KCl, $TiCl_4$ and argon were used.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

continued

2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P.
Zh. Neorg. Khim. 1966, 11, 1765 -
Russ. J. Inorg. Chem. (Eng. Transl.) 1966, 11, 945 - 48. (*).

VARIABLES:

T/K = 1096 - 1213
P/kPa = 34.248 - 65.456

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: continued

T/K	P/atm	10^3 x_1/mol fraction	10^3 k/mol fraction atm^{-1}
1174	0.338	23	69
1174	0.338	24	70
1174	0.338	26	77
1174	0.479	32	66
1174	0.646	45	70
1174	0.646	48	74
1213	0.338	22	64
1213	0.338	24	72
1213	0.479	29	60
1213	0.574	35	61
1213	0.646	37	58
1213	0.646	39	60

Smoothed Data:
Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -2.86 + 2000/(T/K) \pm 0.02$$

The solubility of $TiCl_4$ as a function of temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(P/\text{atm}) - 2.86 + 2000/(T/K) \pm 0.02$$

The enthalpy of solution is:

$$\Delta H/\text{kJ mol}^{-1} = -38.1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0] (2) Potassium chloride; KCl; [7447-40-7]	Kurmaev, R. Kh.; Amirova, S. A. **Zh. Neorg. Khim.** 1968, 13, 2258 - 62; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1968, 13, 1166 - 68. (*).
VARIABLES:	**PREPARED BY:**
T/K = 1123 - 1173	N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $TiCl_4$ in molten KCl at different temperatures are reported to be:

t/°C	C_1/mass%	$10^2\ x_1^a$/mol fraction
850	3.87	1.52
880	3.15	1.24
900	2.94	1.15

^{a} Calculated by the compiler.
Pressure of $TiCl_4$ was the vapor pressure of liquid $TiCl_4$ at 160°C.

Smoothed Data:

Temperature dependence of C_1 is expressed by the equation:

$$\log(C_1/\text{mass\%}) = -2.278 + 3214/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 1.3\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.
Vapors of titanium tetrachloride were passed through the molten KCl, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the tetrachloride within 2 - 3 min. The saturated melt was solidified and titanium was determined volumetrically.

SOURCE AND PURITY OF MATERIALS:

Titanium tetrachloride was of 99.99% purity.
Potassium chloride was of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titaniun tetrachloride; $TiCl_4$; [7550-45-0]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS:

1. Maksimov, V. S.; Smirnov, M. V. Zh. Prikl. Khim. 1966, 39, 931 - 34; J. Appl. Chem. U.S.S.R.(Eng. Transl.) 1966, 39, 872 - 75. (*).

continued

VARIABLES:

T/K = 1000 - 1170

P/kPa = 10.234 - 45.191

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed up to P_{TiCl_4} = 0.5 atm. Values of solubility (x_1) and the constant k (= x_1/P) at various temperatures are given as:

T/K	P/atm	10^3 x_1/mol fraction	10^2 k/mol fraction atm^{-1}
1000	0.226	81	35.8
1000	0.226	86	38.1
1008	0.423	127	30.0
1010	0.101	30	29.7
1015	0.173	54	31.2
1015	0.173	51	29.5
1043	0.226	61	27.0
1048	0.240	70	29.2
1051	0.423	92	21.7
1051	0.423	98	23.2
1053	0.446	118	26.4
1053	0.446	120	26.9
1060	0.173	43	24.9
1062	0.263	63	24.0
1063	0.242	53	21.9
1065	0.251	68	27.1
1070	0.313	61	19.5
1070	0.313	69	22.0
1072	0.260	55	21.2
1072	0.260	60	23.1

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

A known amount of the melt was kept in contact with argon containing vapors of titanium tetrachloride with a specific partial pressure. It was allowed to reach equilibrium for at least 8 hrs. The saturated melt was solidified and analyzed for titanium using a calorimetric method.

SOURCE AND PURITY OF MATERIALS:

Titanium tetrachloride and rubidium chloride were of "pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Rubidium chloride; RbCl; [7791-11-9]

ORIGINAL MEASUREMENTS: continued

2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P.
Zh. Neorg. Khim. 1966, 11, 1765 - 70;
Russ. J. Inorg. Chem. (Eng. Transl.) 1966, 11, 945 - 48. (*).

VARIABLES:

T/K = 1000 - 1170

P/kPa = 10.234 - 45.191

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: continued

T/K	P/atm	10^3 x_1/mol fraction	10^2 k/mol fraction atm^{-1}
1078	0.232	54	23.3
1089	0.226	43	19.0
1089	0.240	52	21.7
1107	0.101	20	19.8
1107	0.242	42	17.4
1107	0.242	45	18.6
1107	0.232	46	19.8
1107	0.356	68	19.1
1107	0.260	51	19.6
1107	0.263	51	19.4
1107	0.423	73	17.3
1107	0.446	88	19.7
1115	0.313	55	17.6
1136	0.232	39	16.8
1136	0.232	42	18.1
1141	0.240	44	18.3
1156	0.263	42	16.0
1169	0.260	38	14.6
1169	0.260	39	15.0
1170	0.446	60	13.5

Smoothed Data:

Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -2.92 + 2430/(T/K) \pm 0.03$$

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0] (2) Rubidium chloride; RbCl; [7791-11-9]	1. Maksimov, V. S.; Smirnov, M. V. **J. Appl. Chem. U.S.S.R.** 1966, **39**, 872 - 75. 2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P. **Russ. J. Inorg. Chem.** 1966, **11**, 945 - 48.
VARIABLES:	PREPARED BY:
T/K = 1000 - 1170 P/kPa = 10.234 - 45.191	N. P. Bansal

EXPERIMENTAL VALUES:

continued

The solubility of $TiCl_4$ as a function of temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(P/\text{atm}) - 2.92 + 2430/(T/K)$$

The enthalpy of solution is:

$$\Delta H/\text{kJ mol}^{-1} = -46.4$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Cesium chloride; CsCl; [7647-17-8]

ORIGINAL MEASUREMENTS:

1. Smirnov, M. V.; Maksimov, V. S.

Electrochem. Molten Solid Electrolytes <u>1967</u>, 5, 33 - 39.

continued

VARIABLES:

T/K = 934 - 1163

P/kPa = 7.903 - 70.826

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed up to P_{TiCl_4} = 0.7 atm. Values of solubility (x_1) and the constant k (= x_1/P) at various temperatures are given as:

T/K	P/atm	10^2 x_1/mol fraction	10^2 k/mol fraction atm^{-1}
934	0.251	27.6	110.0
934	0.251	28.0	111.6
934	0.267	29.5	110.5
934	0.329	34.9	--
934	0.359	33.5	--
943	0.585	33.8	--
943	0.585	33.7	--
948	0.303	26.9	88.8
948	0.303	28.1	92.7
965	0.236	17.1	72.5
971	0.383	30.4	79.4
971	0.383	31.7	82.8
981	0.257	16.5	64.2
1000	0.328	24.2	73.8
1005	0.078	4.7	60.3
1005	0.084	5.4	64.3
1005	0.181	12.2	67.4
1005	0.181	12.4	68.5
1005	0.208	12.6	60.6
1005	0.236	16.6	70.3

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

Details and diagram of the apparatus used for solubility measurements are given in the original paper. A known amount of the melt was kept in contact with argon containing vapors of titanium tetrachloride with a specific partial pressure. It was allowed to attain equilibrium for about 8 hrs. The saturated melt was solidified and analyzed for titanium using a calorimetric method.

SOURCE AND PURITY OF MATERIALS:

"Pure" titanium tetrachloride which was further purified by double distillation over copper shavings in a stream of pure argon was used.

Cesium chloride was "chemically pure" grade.

Argon was freed from oxygen and moisture by passing over anhydrous P_2O_5, Cu shavings heated to 450° and titanium shavings heated to 850°C.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Cesium chloride; CsCl; [7647-17-8]

ORIGINAL MEASUREMENTS: continued

2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P.
Zh. Neorg. Khim. 1966, 11, 1765 - 70;
Russ. J. Inorg. Chem. (Eng. Transl.) 1966, 11, 945 - 48. (*).

VARIABLES:

T/K = 934 - 1163
P/kPa = 7.903 - 70.826

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: continued

T/K	P/atm	10^2 x_1/mol fraction	10^2 k/mol fraction atm^{-1}
1005	0.267	17.8	66.7
1005	0.329	19.2	58.4
1005	0.329	19.5	59.3
1005	0.329	20.6	62.6
1005	0.375	24.8	66.1
1005	0.606	36.0	--
1015	0.249	13.5	54.2
1015	0.222	13.6	61.3
1021	0.257	14.2	55.3
1035	0.249	13.2	53.0
1041	0.395	20.3	51.4
1041	0.395	20.5	51.9
1046	0.359	17.7	49.3
1053	0.375	17.2	45.9
1063	0.122	5.6	45.9
1073	0.433	18.7	43.2
1073	0.433	20.7	47.8
1101	0.085	3.2	37.6
1101	0.153	5.2	34.0
1101	0.153	5.6	36.6
1101	0.153	6.1	39.9
1101	0.326	11.2	34.4
1101	0.326	11.5	35.3
1101	0.395	14.1	35.7
1101	0.648	23.1	35.6

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0] (2) Cesium chloride; CsCl; [7647-17-8]	1. Smirnov, M. V.; Maksimov, V. S. **Electrochem. Molten Solid Electrolytes** 1967, 5, 33 - 39. 2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P. **Russ. J. Inorg. Chem.** 1966, 11, 945 - 48.
VARIABLES: T/K = 934 - 1163 P/kPa = 7.903 - 70.826	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES: continued

T/K	P/atm	10^2 x_1/mol fraction	10^2 k/mol fraction atm^{-1}
1101	0.648	23.5	36.3
1101	0.699	25.4	36.3
1126	0.262	9.3	35.5
1139	0.318	10.0	31.4
1149	0.370	10.4	28.1
1163	0.294	7.9	26.9
1163	0.294	8.2	27.9

Smoothed Data:

Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -2.95 + 2770/(T/K) \pm 0.027$$

The solubility of $TiCl_4$ as a function of temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(P/\text{atm}) - 2.95 + 2770/(T/K) \pm 0.027$$

The enthalpy of solution is:

$$\Delta H/\text{kJ mol}^{-1} = -53.1$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]

(2) Magnesium chloride; $MgCl_2$; [7786-30-3]

ORIGINAL MEASUREMENTS:

Smirnov, M. V.; Maksimov, V. S.

Electrochem. Molten Solid Electrolytes 1969, 7, 37 - 41.

VARIABLES:

T/K = 993 - 1204

P/kPa = 15.807 - 95.448

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed up to P_{TiCl_4} = 0.94 atm. Values of solubility (x_1) and the constant k (= x_1 /P) at various temperatures are given as:

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
993	0.249	10	40
1000	0.666	32	48
1009	0.568	28	49
1020	0.507	22	43
1034	0.759	32	42
1045	0.786	42	53
1052	0.452	22	49
1069	0.235	12	51
1069	0.363	20	55
1069	0.698	32	46
1069	0.942	46	49
1078	0.666	40	60
1083	0.925	46	50
1098	0.759	46	61
1110	0.507	34	67
1110	0.507	38	75
1117	0.893	54	60
1123	0.156	8	51
1145	0.778	48	62
1155	0.759	64	84

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

The method used for solubility measurements was the same as described earlier (1). A known amount of the melt was kept in contact with argon containing vapors of titanium tetrachloride with a specific partial pressure. It was allowed to reach equilibrium for at least 8 hrs. The saturated melt was solidified and analyzed for titanium using a calorimetric method.

SOURCE AND PURITY OF MATERIALS:

Anhydrous $MgCl_2$ was obtained from Magnesium and very pure $TiCl_4$ and triply distilled in vacuo.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Smirnov, M. V.; Maksimov, V. S.

   Electrochem. Molten Solid Electrolytes 1967, 5, 33.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0] (2) Magnesium chloride; $MgCl_2$; [7786-30-3]	Smirnov, M. V.; Maksimov, V. S. **Electrochem. Molten Solid Electrolytes** 1969, 7, 37 - 41.
VARIABLES: T/K = 993 - 1204 P/kPa = 15.807 - 95.448	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES: continued

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
1175	0.942	90	96
1181	0.893	62	69
1191	0.925	76	82
1191	0.925	82	89
1204	0.898	78	87
1204	0.898	82	91

Smoothed Data:

Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -0.50 - 1890/(T/K) \pm 0.05$$

The solubility of $TiCl_4$ as a function of temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(P/\text{atm}) - 0.50 - 1890/(T/K)$$

The enthalpy of solution is:

$$\Delta H/\text{kJ mol}^{-1} = 36.2$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

1. Maksimov, V. S.; Smirnov, M. V.
Zh. Prikl. Khim. 1966, **39**, 931 - 34;
J. Appl. Chem. U.S.S.R.(Eng. Transl.) 1966, **39**, 872 - 75. (*).

continued

VARIABLES:

T/K = 823 - 1023
P/kPa = 20.265 - 88.355

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Henry's law was obeyed up to P_{TiCl} = 0.9 atm. in the molten eutectic 3 LiCl - 2 KCl. Values of solubility^4(x_1) and the constant k (= x_1/P) at various temperatures are given as:

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
823	0.804	21	26
824	0.299	9	30
838	0.821	22	27
850	0.804	29	36
853	0.299	7	23
859	0.404	12	30
863	0.200	5	25
870	0.810	27	33
877	0.821	30	37
888	0.404	9	22
906	0.200	5	25
906	0.547	12	22
906	0.547	15	27
906	0.648	14	22
906	0.810	21	26
916	0.404	15	37
932	0.872	21	24
943	0.810	24	30
943	0.810	29	36

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

A known amount of the melt was kept in contact with argon containing vapors of titanium tetrachloride with a specific partial pressure. It was allowed to reach equilibrium for at least 8 hrs. The saturated melt was solidified and analyzed for titanium using a calorimetric method.

SOURCE AND PURITY OF MATERIALS:

Titanium tetrachloride was of "pure" grade.

LiCl and KCl were of c.p. grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS: continued
(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0] (2) Lithium chloride; LiCl; [7447-41-8] (3) Potassium chloride; KCl; [7447-40-7]	2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P. **Zh. Neorg. Khim.** 1966, 11, 1765 - 70; **Russ. J. Inorg. Chem.** (Eng. Transl.) 1966, 11, 945 - 48. (*).
VARIABLES: T/K = 823 - 1023 P/kPa = 20.265 - 88.355	PREPARED BY: N. P. Bansal

EXPERIMENTAL VALUES: continued

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
951	0.547	13	24
952	0.648	20	31
970	0.872	27	31
982	0.547	17	31
991	0.648	23	35
1023	0.872	28	32

Smoothed Data:

Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -2.29 - 230/(T/K)$$

The solubility of $TiCl_4$ as a function of temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(P/\text{atm}) - 2.29 - 230/(T/K)$$

The enthalpy of solution is:

$$\Delta H/\text{kJ mol}^{-1} = 4.2$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]
(2) Lithium chloride; LiCl; [7447-41-8]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Mui, J. H.; Flengas, S. N.

Canad. J. Chem. 1962, **40**, 997 - 1008.

VARIABLES: P/kPa: 101.325 (compiler)

T/K = 693 - 773

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubilities (wt%) of titanium tetrachloride in the molten eutectic LiCl - KCl (59 - 41 mol%) at different temperatures are given in graphical form. The solubilities derived from the graph, by the compiler, are:

t/°C	$C_1{}^a$/mass%	$10^3\ x_1{}^b$/mol fraction
420	1.5	4.39
443	1.8	5.27
456	2.0	5.86
478	2.9	8.49
490	3.95	11.57
500	5.0	14.64

[a] Reaction solubilities, $TiCl_4$ reacts with KCl of the melt to give K_2TiCl_6.

[b] Calculated by the compiler.

Smoothed Data:

Temperature dependence of C_1 is expressed by the equation:

$$\log(C_1/\text{mass\%}) = 5.179 - 3508.6/(T/K) \quad \text{(compiler)}$$

std. dev. = 5.9% (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium vapor pressure measurements.

For diagram and details of the apparatus and procedure employed for solubility measurements refer to the original publication.

SOURCE AND PURITY OF MATERIALS:

Commercially pure $TiCl_4$ was further purified by refluxing in the presence of Cu filings for about 2 hours and by fractional distillation in a dry atmosphere.

Reagent grade LiCl and KCl were used for the preparation of the eutectic melt. The melt was purified by HCl treatment following the method of Boston and Smith (1).

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Boston, C. R.; Smith, G. P.

J. Phys. Chem. 1958, **62**, 409.

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

1. Maksimov, V. S.; Smirnov, M. V.

Electrochem. Molten Solid Electrolytes 1968, 6, 30 - 36.
continued

VARIABLES:

T/K = 961 - 1214
P/kPa = 25.939 - 70.826

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

For the solubility of $TiCl_4$ in equimolar NaCl - KCl melt, Henry's law was obeyed up to P_{TiCl} = 0.7 atm. Values of solubility (x_1) and the constant k (= x_1/P) at^{4}various temperatures are given as:

T/K	P/atm	10^4 x_1/mol fraction	10^4 k/mol fraction atm^{-1}
961	0.433	134	31
985	0.492	164	33
1003	0.433	118	27
1003	0.433	156	36
1018	0.503	147	29
1036	0.433	108	25
1041	0.405	129	32
1041	0.405	148	37
1055	0.276	84	30
1070	0.492	129	26
1070	0.492	147	30
1079	0.503	120	24
1083	0.405	108	27
1083	0.405	115	28
1085	0.401	125	31
1111	0.492	109	22
1111	0.492	111	23
1111	0.552	151	27
1111	0.552	166	30

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Equilibrium at fixed vapor pressure.

Method employed for solubility measurements was the same as described elsewhere (1). A known amount of the melt was kept in contact with the vapor phase consisting of argon and titanium tetrachloride for about 8 hrs. The saturated melt was solidified and analyzed for titanium using a calorimetric method.

SOURCE AND PURITY OF MATERIALS:

Not given.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Smirnov, M. V.; Maksimov, V. S.

Electrochem. Molten Solid Electrolytes 1967, 5, 33.

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS: continued

2. Smirnov, M. V.; Maksimov, V. S.; Khaimenov, A. P.
Zh. Neorg. Khim. 1966, 11, 1765 - 70;
Russ. J. Inorg. Chem. (Eng. Transl.) 1966, 11, 945 - 48. (*).

VARIABLES:

T/K = 961 - 1214
P/kPa = 25.939 - 70.826

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES: continued

1126	0.256	61	24
1126	0.405	83	20
1126	0.405	93	23
1126	0.503	104	21
1126	0.699	157	22
1126	0.699	188	27
1131	0.401	95	24
1131	0.401	103	26
1155	0.552	113	20
1171	0.401	71	18
1194	0.552	97	18
1194	0.552	111	20
1196	0.699	131	19
1196	0.699	144	21
1214	0.256	45	18

Smoothed Data:

Temperature dependence of k is expressed by the relation:

$$\log(k/\text{mol fraction atm}^{-1}) = -2.79 + 1300/(T/K) \pm 0.05$$

The dependence of solubility on temperature and the partial pressure of $TiCl_4$ in the gas phase is given by:

$$\log(x_1/\text{mol fraction}) = \log(P/\text{atm}) - 2.79 + 1300/(T/K) \pm 0.05$$

The enthalpy of dissolution is: $\Delta H/\text{kJ mol}^{-1} = -25.1$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;

Russ. J. Inorg. Chem. (Eng. Transl.) 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 973 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $TiCl_4$ in molten NaCl - KCl (50 - 50 mol%) mixture at different temperatures are reported to be:

t/°C	C_1/mass%	10^3 $x_1{}^a$/mol fraction
700	2.84	9.95
750	2.68	9.39
800	2.39	8.37
850	2.30	8.06
900	2.18	7.64

[a] Calculated by the compiler.
Pressure of $TiCl_4$ was the vapor pressure of liquid $TiCl_4$ at 160°C.

Smoothed Data:

Temperature dependence of C_1 is expressed by the equation:

$$\log(C_1/\text{mass\%}) = -0.243 + 678.8/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 0.8\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.

Vapors of titanium tetrachloride were passed through the molten NaCl - KCl mixture, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the tetrachloride within 2 - 3 min. The saturated melt was solidified and titanium was determined volumetrically.

SOURCE AND PURITY OF MATERIALS:

Titanium tetrachloride was of 99.99% purity.

Sodium and potassium chlorides were of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Titanium tetrachloride; $TiCl_4$; [7550-45-0]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Flengas, S. N.

Ann. N. Y. Acad. Sci. 1960, **79**, 853 - 72.

VARIABLES:

T/K = 963 & 993
P/kPa = 87.993

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

It has been reported that titanium tetrachloride vapors react with the fused NaCl - KCl (50 - 50 mol%) mixture. After an exposure of 30 hrs. to the vapors of titanium tetrachloride, the following concentrations are found in the melt solution:

t/°C	Solubility[a]/mass%	10^2 x_1[b]/mol fraction
690	14	4.91
720	5	1.75

[a] Equilibrium concentration was not reached even after 30 hrs; after sufficient time saturation concentration would be attained eventually, resulting in the formation of K_2TiCl_6 corresponding to the amount of KCl present in the melt.

[b] Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Thermobalance technique.
The diagram and details of the apparatus and procedure employed for solubility measurements are described in the original paper. Briefly, the increase in weight of the melt in contact with vapors of titanium tetrachloride was directly observed with a quartz spring balance. Temperature of the melt was controlled within within ± 0.5°C.

SOURCE AND PURITY OF MATERIALS:

Commercially pure titanium tetrachloride was purified by distillation in the presence of copper shavings under a stream of argon. The first part of the distillate was rejected.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Vanadyl trichloride; $VOCl_3$; [7727-18-6]

(2) Sodium chloride; NaCl; [7647-14-5]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh.. Neorg. Khim. 1968, 13, 2258 - 62;
Russ. J. Inorg. Chem. (Eng. Transl.) 1969, 13, 1166 - 68. (*).

VARIABLES:

T/K = 1093 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $VOCl_3$ in molten NaCl at different temperatures are reported to be:

t/°C	C_1/mass%	$10^3\ x_1{}^a$/mol fraction
820	1.9	6.41
850	3.23	10.90
860	3.44	11.61
880	4.35	14.68
900	5.45	18.40

Pressure of $VOCl_3$ was the vapor pressure of liquid $VOCl_3$ at 160°C.
[a] Calculated by the compiler.

Smoothed Data:
Temperature dependence of C_1 is expressed by the relation:

$$\log(C_1/\text{mass\%}) = 6.879 - 7191/(T/K) \quad \text{(compiler)}$$

std. dev. = 2.4% (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.
Vapors of vanadyl trichloride were passed through the molten NaCl, kept at a constant temperature, for about 10 - 15 min. The melt was saturated with the trichloride within 2 - 3 min. The saturated melt was solidified and analyzed for vanadium by the usual method of titration with aqueous acidified iron sulfate.

SOURCE AND PURITY OF MATERIALS:

Vanadyl trichloride was obtained by repeated rectification of $TiCl_4$ - $VOCl_3$ mixture; the concentration of titanium tetrachloride in the vanadyl trichloride was less than 0.01%.
Sodium chloride was "chemically pure" grade.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Vanadyl trichloride; $VOCl_3$; [7727-18-6]

(2) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;
Russ. J. Inorg. Chem. (Eng. Transl.) 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 1073 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $VOCl_3$ in molten KCl at different temperatures are reported to be:

t/°C	C_1/mass%	$10^3\ x_1{}^a$/mol fraction
800	4.5	19.36
830	9.5	40.87
840	11.4	49.05
850	13.5	58.08
860	15.6	67.12
880	19.5	83.90
900	25.3	108.85

[a] Calculated by the compiler.
Pressure of $VOCl_3$ was the vapor pressure of liquid $VOCl_3$ at 160°C.

Smoothed Data:
Temperature dependence of C_1 is given by the equation:

$$\log(C_1/\text{mass\%}) = 9.254 - 9162.9/(T/K) \quad \text{(compiler)}$$

$$\text{std. dev.} = 4.4\% \quad \text{(compiler)}$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.

Vapors of vanadyl trichloride were passed through the molten KCl, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the trichloride within 2 - 3 min. The saturated melt was solidified and analyzed for vanadium by the usual method of titration with aqueous acidified iron sulfate.

SOURCE AND PURITY OF MATERIALS:

Vanadyl trichloride was obtained by repeated rectification of $TiCl_4$ - $VOCl_3$ mixture; the concentration of titanium tetrachloride in the vanadyl trichloride was less than 0.01%

Potassium chloride was of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Vanadyl trichloride; $VOCl_3$; [7727-18-6]
(2) Sodium chloride; NaCl; [7647-14-5]
(3) Potassium chloride; KCl; [7447-40-7]

ORIGINAL MEASUREMENTS:

Kurmaev, R. Kh.; Amirova, S. A.
Zh. Neorg. Khim. 1968, 13, 2258 - 62;

Russ. J. Inorg. Chem. (Eng. Transl.); 1968, 13, 1166 - 68. (*).

VARIABLES:

T/K = 973 - 1173

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

Solubilities of $VOCl_3$ in molten NaCl - KCl (50 - 50 mol%) mixture at different temperatures are reported to be:

t/°C	C_1/mass%	10^3 x_1^a/mol fraction
700	5.23	20.07
750	6.38	24.48
800	6.40	24.56
850	8.75	33.58
900	10.80	41.44

[a] Calculated by the compiler.
Pressure of $VOCl_3$ was the vapor pressure of liquid $VOCl_3$ at 160^{b}C.

Smoothed Data:

Temperature dependence of C_1 is expressed by the relation:

$$\log(C_1/\text{mass\%}) = 2.483 - 1733/(T/K) \quad \text{(compiler)}$$

std. dev. = 4.1% (compiler)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method.

Vapors of vanadyl trichloride were passed through the molten NaCl - KCl mixture, kept at a constant temperature, for about 10 - 15 min. The melt became saturated with the trichloride within 2 - 3 min. The saturated melt was solidified and analyzed for vanadium by the usual method of titration with aqueous acidified iron sulfate.

SOURCE AND PURITY OF MATERIALS:

Vanadyl trichloride was obtained by repeated rectification of $TiCl_4$ - $VOCl_3$ mixture; the concentration of titanium tetrachloride in vanadyl trichloride was less than 0.01%.

Sodium chloride and potassium chloride were of "chemically pure" grade.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Methane; CH_4; [74-82-8]
(2) Sodium nitrate; $NaNO_3$; [7631-99-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Paniccia, F.; Zambonin, P. G.

J. Chem. Soc. Faraday Trans. I 1972, 68, 2083 - 89.

VARIABLES:

$T/K = 508 - 603$
$P/kPa = 10^2$

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solvent was an equimolar molten mixture of sodium and potassium nitrates. The solubilities of methane in the melt at different temperatures are:

T/K	10^8 K_H/mol cm^{-3} bar^{-1}
508	0.82
533	0.97
573	1.3
603	1.5

Smoothed Data:

The temperature dependence of Henry's law constant, K_H, is given by the relation:

$$\log(K_H/\text{mol cm}^{-3}\ \text{atm}^{-1}) = -6.38 - 865/(T/K) \quad \text{(compiler)}$$

std. dev. = 0.8% (compiler)

The enthalpy, ΔH, and the standard entropy, $\Delta S°$, of solution are:

$\Delta H/kJ\ mol^{-1} = 17$ $\Delta S°/J\ K^{-1}\ mol^{-1} = -33$ (at 533K)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

The details of the apparatus and procedure employed for solubility measurements are described elsewhere (1). Briefly, the melt was vacuum degassed for a few hours. The vacuum was disconnected and methane gas introduced at about one bar pressure. The melt was vigorously stirred and pressure changes were noted with a manometer as a function of time until the equilibrium was reached. The amount of gas dissolved was calculated from the final pressure variation after a suitable calibration.

SOURCE AND PURITY OF MATERIALS:

Methane (High Purity Grade) was purified by keeping in contact with Ascarite (A. H. Thomas Co., Philadelphia) for several hours to remove carbon dioxide and other acidic impurities and molecular sieve 5A (Carlo Erba, Milano) at -80°C to remove water.

Reagent grade $NaNO_3$ and KNO_3 were used to prepare the melt which was filtered in the molten state.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

1. Desimoni, E.; Paniccia, F.; Zambonin, P. G.

J. Electroanal. Chem. 1972, 38, 373.

COMPONENTS:

(1) Chloroform; $CHCl_3$; [67-66-3]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Allulli, S.

J. Phys. Chem. 1969, 73, 1084 - 87.

VARIABLES:

one temperature: T/K = 433

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of chloroform in the molten eutectic $LiNO_3$ - KNO_3 at 160°C was found to be too small ($<10^{-7}$ mol(mol of melt)$^{-1}$ mm^{-1}) to be detected with the experimental method used.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

SOURCE AND PURITY OF MATERIALS:

Chloroform (ERBA RP) was distilled under vacuum.

$LiNO_3$ (ERBA RP) was dehydrated at 70°C to avoid hydrolysis. KNO_3 (ERBA RP) was finely powdered and dried under vacuum at 110°C for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

(1) Acetone; $(CH_3)_2CO$; [67-64-1]
(2) Lithium nitrate; $LiNO_3$; [7790-69-4]
(3) Potassium nitrate; KNO_3; [7757-79-1]

ORIGINAL MEASUREMENTS:

Allulli, S.

J. Phys. Chem. 1969, 73, 1084 - 87.

VARIABLES:

one temperature: T/K = 433

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The solubility of acetone in the molten $LiNO_3$ - KNO_3 eutectic at 160°C was found to be too small ($<10^{-7}$ mol(mol of melt)$^{-1}$ mm^{-1}) to be measured with the experimental method employed.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Manometric technique.

SOURCE AND PURITY OF MATERIALS:

Acetone (ERBA RP ACS) was distilled under vacuum.

$LiNO_3$ (ERBA RP) was dehydrated at 70°C to avoid hydrolysis. KNO_3 (ERBA RP) was finely powdered and vacuum dried at 110°C for 24 hr.

ESTIMATED ERROR:

Nothing specified.

REFERENCES:

COMPONENTS:

1 Boron trifluoride; BF_3; [7637-07-2]
2 Lithium fluoride; LiF; [7789-24-4]
3 Beryllium fluoride; BeF_2; [7789-49-7]
4 Zirconium fluoride; ZrF_4; [7783-64-4]
5 Thorium fluoride; ThF_4; [13709-59-6]
6 Uranium fluoride; UF_4; [10049-14-6]

ORIGINAL MEASUREMENTS:

1. Shaffer, J. H.; Grimes, W. R.; Watson, G. M.; **Nuc. Sci. Eng.** 1962, 12, 337 - 340
2. Shaffer, J. H. **U. S. A. E. C. Rept. O. R. N. L -3127**, 1960, 12 - 13.

VARIABLES:

T/K = 773 - 973
P/kPa = 121.59 - 192.52

PREPARED BY:

N. P. Bansal

EXPERIMENTAL VALUES:

The values of Henry's law constant, K_H, for the solubility of BF_3 in the melt LiF - BeF_2 - ZrF_4 - ThF_4 - UF_4 (65-28-5-1-1 mol%) at different temperatures are :

$t/°C$	$10^2 soly/mol\ liter^{-1} atm^{-1}$	$10^5 K_H{}^a/mol\ cm^{-3} atm^{-1}$
500	26.7 ± 0.5	26.7 ± 0.5
550	13.2 ± 0.1	13.2 ± 0.1
600	8.26± 0.25	8.26± 0.25
700	3.46± 0.17	3.46± 0.17

[a] Calculated by the compiler.

Smoothed data:

Temperature dependence of K_H can be expressed by the relation

$$\log(K_H/mol\ cm^{-3} atm^{-1}) = -7.857 + 3296.6/(T/K) \text{ (compiler)}$$

Std. dev. = 2.5% (compiler)

The enthalpy of the solution, ΔH, and the standard entropy of the solution, $\Delta S°$, are :

$$\Delta H/kJ\ mol^{-1} = -63.18$$

$$\Delta S°/J\ K^{-1}\ mol^{-1} = -56.5$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Stripping method.

The solubility of BF_3 in the fluoride melt was determined by a method similar to that described previously for determination of solubility of HF(1). At the experimental temperature, the melt was saturated by flushing with BF_3. A known portion of the saturated melt was transferred to the stripping section of the apparatus. The BF_3 dissolved in the melt was recovered by sparging with helium. The stripped BF_3 was absorbed in an aqueous saturated solution of NaCl. The amount of BF_3 was determined by Booth and Martin (2).

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Not specified.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium oxide; Li_2O; [12057-24-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Kurkjian, C. R.; Russell, L. E.

J. Soc. Glass Tech. 1958, **42**, 130T - 144T.

VARIABLES:

T/K: 1340 - 1740
H_2O P/kPa = 101.3 (760 mmHg)
mol% Li_2O = 23.4 - 39

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various Li_2O-SiO_2 melts in the temperature range 1340 - 1740 K. The solubility as a function of temperature is shown in fig. 1 and of Li_2O content is shown in fig. 2.

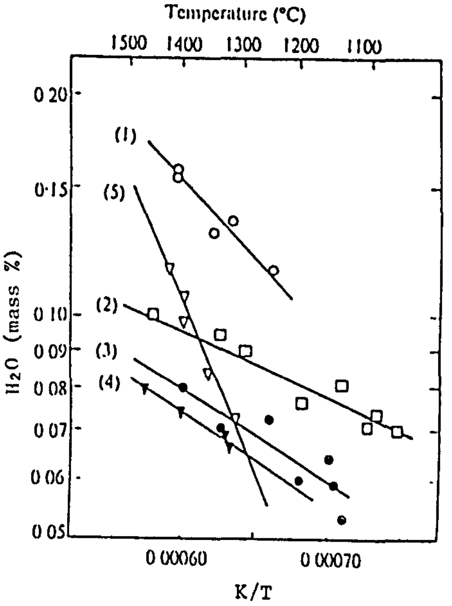


Fig. 1 Solubility of H_2O in Li_2O-SiO_2 melts as a function of temperature; mol% of Li_2O: (1) 39, (2) 33, (3) 29, (4) 25, (5) 23.4

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The stream of H_2O at near one atm. was bubbled up through the melt in a Pt linered mullite tube. The determination of the solubility of H_2O was made by the gas purging method with dried O_2 as described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

The samples were made by melting high purity sand and analytical reagent grade lithium carbonate.

ESTIMATED ERROR:

δ(ppm)/(ppm): within ± 0.10 (authors)

REFERENCES:

1. Russell, L. E.

J. Soc. Glass Tech. 1957, **41**, 304T - 317T.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium oxide; Li_2O; [12057-24-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Kurkjian, C. R.; Russell, L. E.

J. Soc. Glass Tech. 1958, 42, 130T - 144T.

VARIABLES: T/K = 1473 - 1773
H_2O P/kPa = 101.3 (760 mmHg)
mol% Li_2O = 23.4 - 39

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

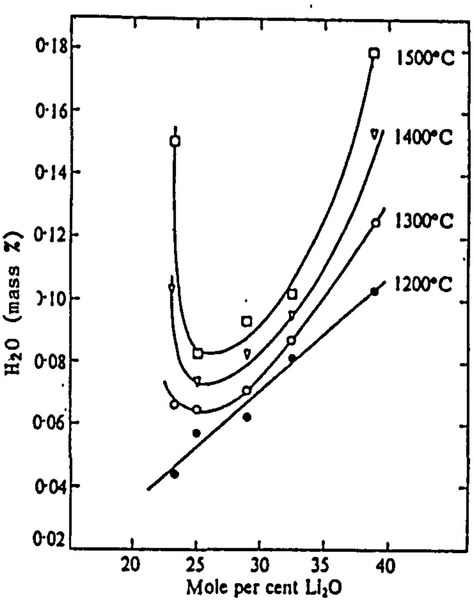


Fig. 2 Solubility of H_2O in Li_2O-SiO_2 melts as a function of mol% Li_2O

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium oxide; Li_2O; [12057-24-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.

Trans. Met. Soc. AIME 1963, **227**, 492 - 500.

VARIABLES:

mol% Li_2O: 2 - 66
H_2O P/ kPa = 19.5 (146 mmHg)
T/K = 1678 - 1925

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various Li_2O-SiO_2 melts as a function of mol% Li_2O at P_{H_2O} = 146 mmHg in graphical form only, which is shown in fig. 1. The effect of temperature on the solubility is also given in fig.2.

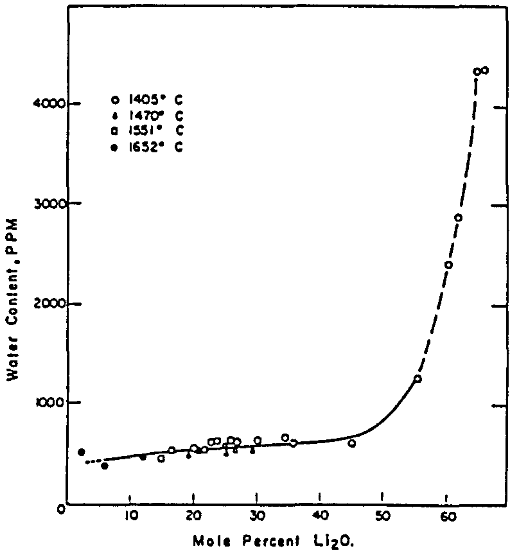


Fig. 1 Solubility of H_2O in Li_2O-SiO_2 melts as a function of Li_2O concentration

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of N_2 + H_2O near one atm., and were quenched.

The solubility of H_2O was determined by the method of analysis described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

The silicates were prepared by mixing together the purest available constituents.
SiO_2: Brazilian rock quartz.
Li_2O: Made from carbonate.

ESTIMATED ERROR:

Not described in the paper, but is estimated to be similar to that in ref. 1

δ(ppm)/(ppm) = ± 0.05 (M.S.)

REFERENCES:

1. Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J.

Trans. Met. Soc. AIME 1956, **206**, 1568 - 1576.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Lithium oxide; Li_2O;
[12057-24-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.

Trans. Met. Soc. AIME 1963, 227, 492 - 500.

VARIABLES: T/K = 1678 - 1925
H_2O P/kPa = 19.5 (146 mmHg)
mol% Li_2O = 19 - 46

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

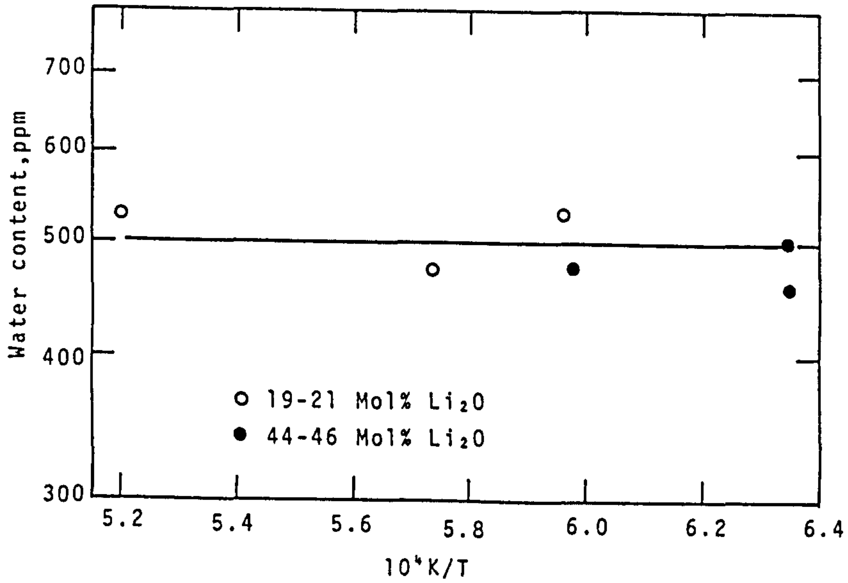


Fig. 2 Solubility of H_2O in Li_2O-SiO_2 melts as a function of temperature.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Sodium oxide; Na_2O; [1313-59-3] (3) Silica; SiO_2; [7631-86-9]	Kurkjian, C. R.; Russell, L. E. **J. Soc. Glass Tech.** 1958, **42**, 130T - 144T.
VARIABLES: T/K: 1300 - 1730 mol% Na_2O = 16.6 - 50 H_2O P/kPa = 7.3 (55 mmHg) - 101.3 (760 mmHg)	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various Na_2O-SiO_2 melts in the temperature range 1300 - 1730 K and at P_{H_2O} = 7.3 - 101.3 KPa in graphical form: the solubility as a function of H_2O partial pressure for $Na_2O.2.4SiO_2$ at 1100°C is shown in fig. 1 and the variations of the solubility with temperature and with Na_2O content are shown in figs. 2, 3.

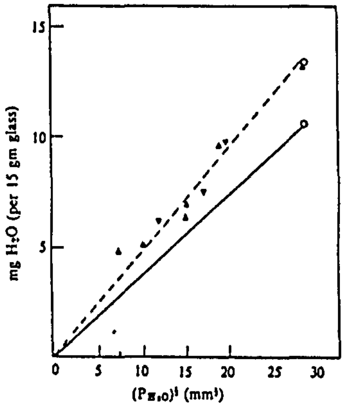


Fig. 1 Solubility of H_2O in $Na_2O.2.2SiO_2$ as a function of $P_{H_2O}^{1/2}$ at 1100°C: Λ - result by O_2, v - result by N_2, solid line - result in ref. 1

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The stream of O_2 + H_2O at nearly one atm. was bubbled up through the melt in a mullite tube. The determination of the solubility of H_2O was carried out by the gas purging method with dried O_2 as described in ref. 1.	The samples were made by melting high purity sand and analytical reagent grade sodium carbonate.
	ESTIMATED ERROR: δ(ppm)/(ppm): within ± 0.10 (authors)
	REFERENCES: 1. Russell, L. E. **J. Soc. Glass Tech.** 1957, **41**, 304T - 317T.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium oxide; Na_2O; [1313-59-3]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Kurkjian, C. R.; Russell, L. E.

J. Soc. Glass Tech. 1958, 42, 130T - 144T.

VARIABLES:
$T/K = 1300 - 1730$
H_2O $P/kPa = 7.3 - 101.3$
mol% Na_2O = 16.6 - 50

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

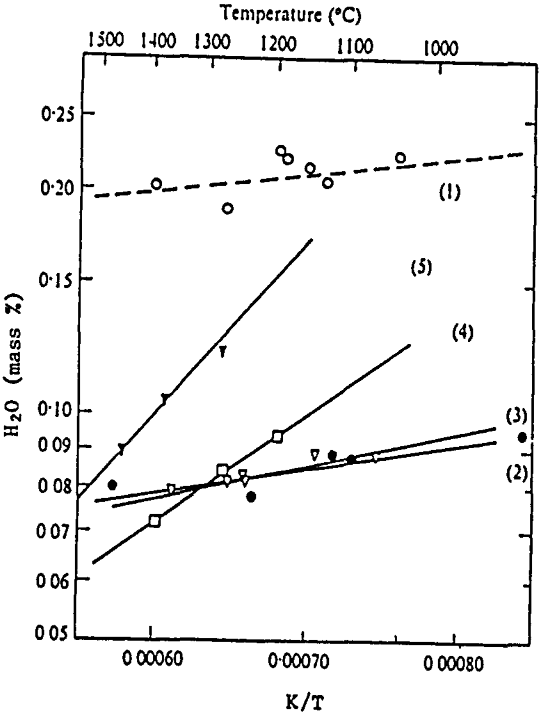


Fig. 2 Solubility of H_2O in Na_2O-SiO_2 melts as a function of temperature; mol% Na_2O: (1) 50, (2) 30, (3) 25, (4) 20, (5) 16.6

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium oxide; Na_2O; [1313-59-3]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Kurkjian, C. R.; Russell, L. E.

J. Soc. Glass Tech. 1958, 42, 130T - 144T.

VARIABLES:
$T/K = 1430 - 1740$
H_2O $P/kPa = 101.3$
mol% $Na_2O = 16.6 - 50$

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

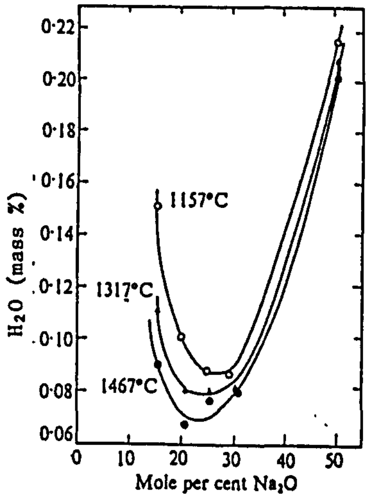


Fig. 3 Solubility of H_2O in Na_2O-SiO_2 melts as a function of mol% Na_2O.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium oxide; Na_2O;
[1313-59-3]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Tomlinson, J. W.

J. Soc. Glass Tech. **1956**, **40**, **25T - 31T.**

VARIABLES:

T/K = 1173, 1273, 1373
H_2O P/kPa = 6.5 - 101.3
mass ratio m_2/m_3 = 31/69

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The author reported the solubility of H_2O in sodium silicate, approximately $Na_2O.2SiO_2$, at 900, 1000 and 1100°C and at P_{H_2O} = 101.3, 24.1, 11.9 and 6.5 kPa in graphical form only.
The H_2O solubility at 1100°C with various H_2O pressures is shown in fig. 1 and the effect of temperature on the logarithm of the solubility of H_2O corrected at P_{H_2O} = 101.3 KPa is in fig. 2

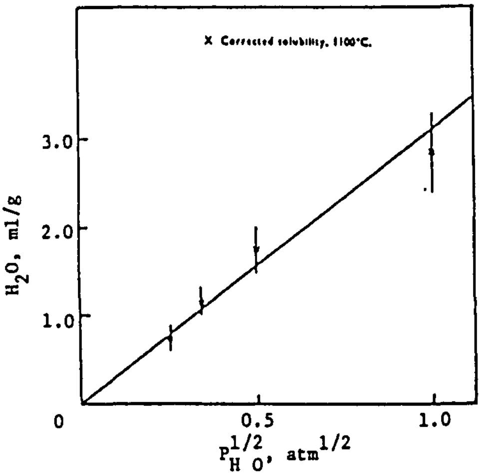


fig. 1

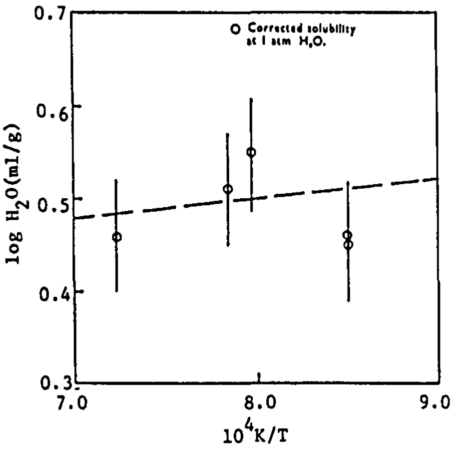


fig. 2

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

One gram of sample rod in a Pt boat was equilibrated with the stream of N_2 + H_2O at nearly one atm. and was quenched. Analysis of the melts for H_2O was carried out by reheating, trapping in a liquid air trap and determining the pressure change on freezing in solid CO_2 and evaporating into a known volume.

SOURCE AND PURITY OF MATERIALS:

Sodium silicate was prepared by fusing Analar sodium carbonate with silica obtained from selected pieces of mineral quartz. After sintering at 500°C to remove CO_2, the sample was fused in vacuum, and rods 0.5 mm diameter were drawn from the melt in air.

ESTIMATED ERROR:

δ(ppm)/(ppm): < ± 0.15 (author)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Sodium oxide; Na_2O; [1313-59-3]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J.

J. Metals 1956, 8, 1568 - 1576.

VARIABLES:

T/K = 1396 & 1640
mol ratio $n_2/n_3 = 2.4$
H_2O P/kPa = 25.3 (190 mmHg)

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors measured the solubility of H_2O in 30% Na_2O - 70% SiO_2 (mass) glass melts with 190 mmHg of H_2O vapor pressure at 1123°C and 1367°C and reported the calculated solubility for 760 mmHg of H_2O by using the equation:

$$C_{H_2O} = kP_{H_2O}^{1/2}$$

where C_{H_2O} is the solubility of H_2O and k is constant for constant temperature and for constant composition of the melt.

Temperature °C	ppm (mass/mass) of H_2O at P_{H_2O} = 25.33 kPa *	ppm (mass/mass) of H_2O at P_{H_2O} = 101.3 kPa
1123	443	885
1367	423	846

* Actual experimental value (estimated by M. S.)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A slag in a Pt crucible was equilibrated with the stream of nearly one atm., of $N_2 + H_2O$, and was quenched by lowering the crucible into either Hg or H_2O

The solubility of H_2O was determined by applying the vacuum fusion technique to the sample wrapped with Al foil at about 1600°C.

SOURCE AND PURITY OF MATERIALS:

The slags were prepared by mixing the chemically pure components.

ESTIMATED ERROR:

analysis of H_2O:
$\delta(\text{ppm})/(\text{ppm}) > \pm 0.048$ (authors)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Potassium oxide; K_2O; [12136-45-7]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Kurkjian, C. R.; Russell, L. E.

J. Soc. Glass Tech. 1958, **42**, 130T - 144T.

VARIABLES: T/K: 1230 - 1820
H_2O P/kPa = 101.3 (760 mmHg)
mol% K_2O = 17.5 - 45

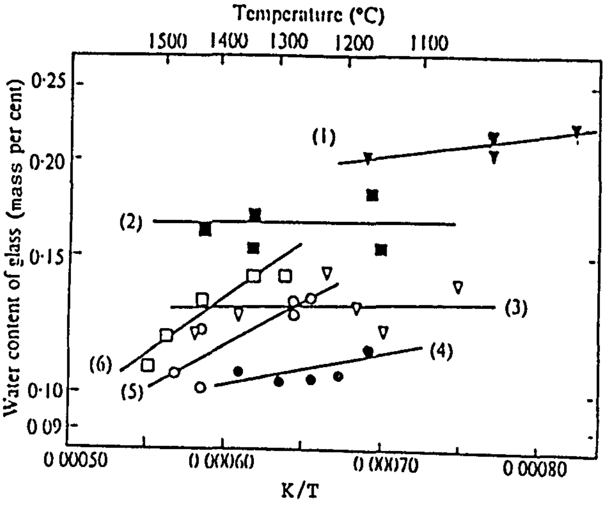
PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various K_2O-SiO_2 melts in the temperature range about 1230 - 1820 K. The solubility as a function of temperature is in fig. 1 and of K_2O is in fig. 2.

Fig. 1 Solubility of H_2O in K_2O-SiO_2 melts as a function of 1/T; mol% K_2O: (1) 45, (2) 40, (3) 33.3, (4) 31.6, (5) 20.3, (6) 17.5



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The stream of H_2O at near one atm. was bubbled up through the melt in a mullite tube. The determination of the solubility of H_2O was made by the gas purging method with dried O_2 as described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

The samples were made by melting high purity sand and analytical reagent grade potassium carbonate.

ESTIMATED ERROR:

δ(ppm)/(ppm): within ± 0.10 (authors)

REFERENCES:

1. Russell, L. E.

J. Soc. Glass Tech. 1957, **41**, 304T - 317T.

COMPONENTS: (1) Water; H_2O; [7732-18-5] (2) Potassium oxide; K_2O; [12136-45-7] (3) Silica; SiO_2; [7631-86-9]	**ORIGINAL MEASUREMENTS:** Kurkjian, C. R.; Russell, L. E. **J. Soc. Glass Tech.** 1958, **42**, 130T - 144T.
VARIABLES: T/K = 1373 - 1673 H_2O P/kPa = 101.3 (760 mmHg) mol% K_2O = 17.5 - 45	**PREPARED BY:** M. Shinmei

EXPERIMENTAL VALUES:

continued

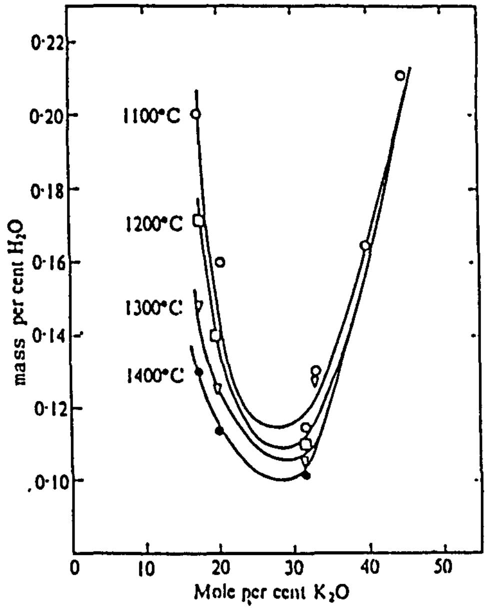


Fig. 2 Solubility of H_2O in K_2O-SiO_2 melts as a function of K_2O content.

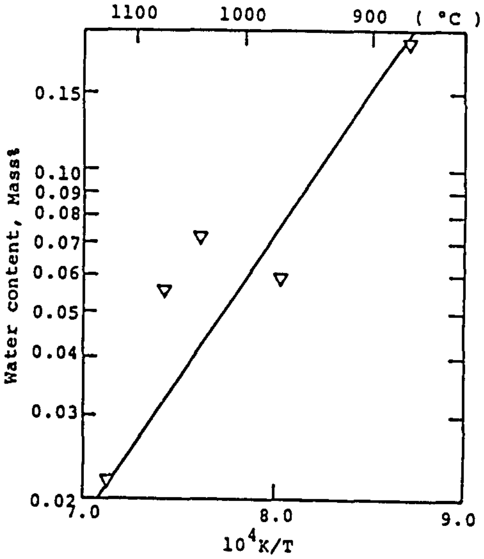
AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	**SOURCE AND PURITY OF MATERIALS:**
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Cesium oxide; Cs_2O; [20281-00-9] (3) Silica; SiO_2; [7631-86-9]	Russell, L. E. **J. Soc. Glass Tech.** 1957, **41**, 304T - 317T.
VARIABLES: T/K: 1150 - 1400 H_2O P/kPa = 101.3(760 mmHg) mol ratio n_2/n_3 = 0.5	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

The author reported the solubility of H_2O in $Cs_2O.2SiO_2$ melts as a function of reciprocal temperature in the temperature range about 1150 - 1400 K, and in graphical form only.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The stream of O_2 + H_2O at near one atm. was bubbled up through the melt in a mullite tube. The determination of the solubility of H_2O was made by the gas purging method with dried O_2 (Although no details about the partial pressure of H_2O bubbled were given the solubility data shown are corresponding to that at P_{H_2O} = 1 atm.)

SOURCE AND PURITY OF MATERIALS:

The samples were made by melting high purity sand and analytical reagent grade cesium carbonate.

ESTIMATED ERROR:

δ(ppm)/(ppm): it may be more than ± 0.10 because of high volatility of Cs_2O. (authors)

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Calcium oxide; CaO; [1305-78-8] (3) Silica; SiO_2; [7631-86-9]	Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J. **J. Metals** 1956, **8**, 1568 - 1576.
VARIABLES: T/K = 1823 H_2O P/kPa = 101.3 (1 atm.) Mol% CaO = 34.5 - 58.7	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H in various CaO-SiO_2 melts at 1500°C under steam atmosphere.

Mass %		Mol %		ppm(mass/mass)	
CaO	SiO_2	CaO	SiO_2	H*	H_2O**
33	67	34.5	65.5	74.3	664
50	50	51.7	48.3	82.9	741
57	43	58.7	41.3	85.1	760

* Average value (authors)

** Calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A slag in a Pt crucible was equilibrated with a stream of nearly one atmosphere of $N_2 + H_2O$ or H_2O, and was quenched by lowering the crucible into either Hg or H_2O.

The solubility of H_2O was analyzed as a H content by the vacuum fusion technique for the sample wrapped with Al foil at about 1600°C.

SOURCE AND PURITY OF MATERIALS:

The slags were prepared by mixing the chemically pure constituents.

ESTIMATED ERROR:

Analysis of H_2O:
δ(ppm)/(ppm) = ± 0.048 (authors)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Fukushima, T.; Iguchi, Y.;
Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, **6**, 225 - 232.

VARIABLES: Mol% CaO: 43 - 61
H_2O P/ kPa = 38.5 (289 mmHg)
T/K = 1773, 1823, 1873

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO-SiO_2 melts at 1500°C, 1550°C and 1600°C under the pressure of H_2O at 289 mm Hg, and in graphical form only. The effect of temperature on the solubility is shown in fig. 1 and of composition of the melt at 1600°C is shown in fig. 2.

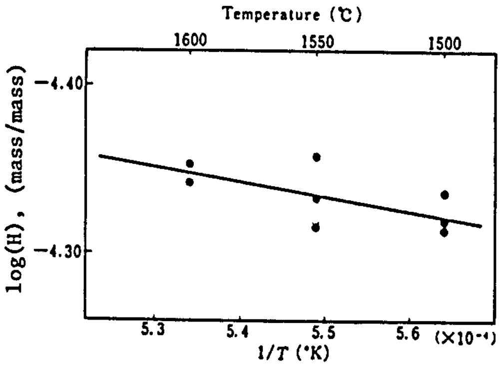


fig. 1, Effect of temperature on hydrogen content in 63 mass% SiO_2 - 37 mass% CaO melts; P_{H_2O} = 38.5 KPa.

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., and was quenched. The H_2O in the sample was reduced to H_2 by Al at 1550 - 1600°C and was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%)

SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

analysis of H_2O:
δ(ppm)/(ppm) = ± 0.08 (authors)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Fukushima, T.; Iguchi, Y.;
Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966,
6, 225 - 232.

VARIABLES:

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

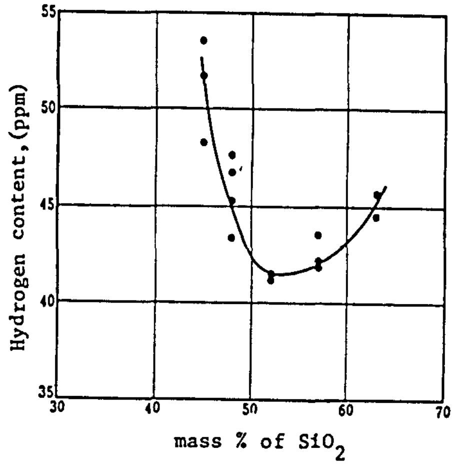


fig. 2, Effect of SiO_2 concentration on hydrogen content of CaO-SiO_2 melts; P_{H_2O} = 38.5 KPa and 1600°C

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

T/K = 1773 - 1873
H_2O P/ kPa= 38.5 (289 mmHg)
mol ratio n_2/n_3 = 0.63 & 1.26

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of water in CaO-SiO_2 melts as a function of temperature, and in graphical form only.

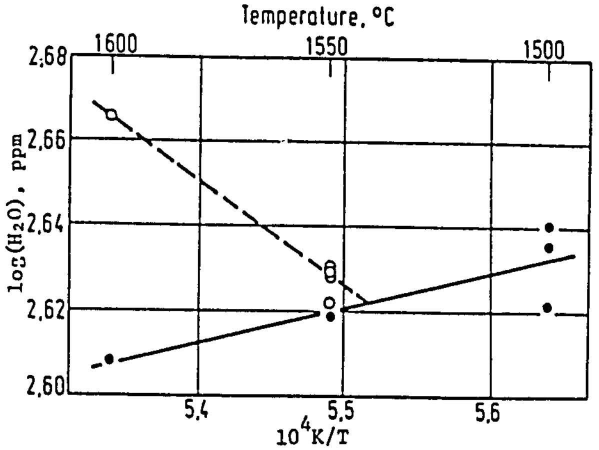


fig.1, Solubility of water in CaO-SiO_2 melts at P_{H_2O}= 38.5 KPa; molratio of CaO/SiO_2 are, —●— 0.63, --○--1.26.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream at nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced to H_2 by Al at 1550 - 1600°C, which was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: made by thermal decomposition of reagent grade calcium carbonate

SiO_2: high purity quartz (over 99.9%)

ESTIMATED ERROR:

analysis of Hydrogen:
δ(ppm)/(ppm) = ± 0.06 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron and Steel Proc. of the Intl. Symp. on Met. Chem. - Appl. on Ferrous Metallurgy held: Univ. of Sheffield, July 19 - 21, 1971, The Iron and Steel Inst. London, UK, 1973, 28 - 30.

VARIABLES: $T/K = 1873$
H_2O $P/kPa = 38.5$ (289 mmHg)
mol ratio $n_2/n_3 = 0.63 - 1.26$

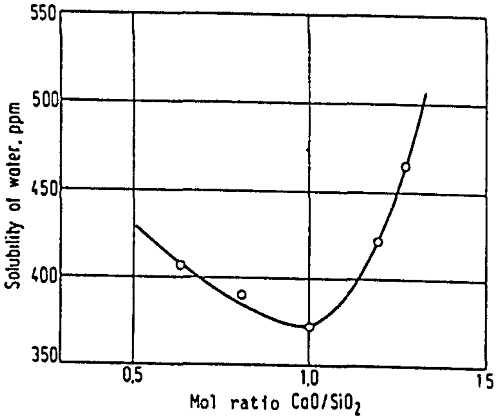
PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various $CaO-SiO_2$ melts at 1600°C in graphical form. The authors provided the original data for this file.

mol ratio CaO/SiO_2	ppm(mass/mass) H_2O
0.63	405
0.80	390
1.00	372
1.18	419
1.26	427



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the stream of Ar + H_2O of nearly one atm., and was quenched in a H_2O cooled Cu mold.

H_2O in the sample was reduced to H_2 with Al at 1550 - 1600°C, and was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%)

SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

Analysis of H_2O:
$\delta(ppm)/(ppm) = \pm 0.08$ (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

   Trans. Iron Steel Jpn. 1966, 6, 225 - 232.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Calcium oxide; CaO; [1305-78-8] (3) Silica; SiO_2; [7631-86-9]	Wahlster, M.; Reichel, H. H. **Arch. Eisenhuttenwes.** 1969, 40, 19 - 25.
VARIABLES:	PREPARED BY:
T/K = 1873 H_2O P/kPa = 101.3 (760 mmHg) mol% SiO_2 = 45 - 60	M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in CaO-SiO_2 melts at 1873 K and at P_{H_2O} = 101.3 kPa in mass% of H (Actual measurements were carried out at P_{H_2O} = 31.2 kPa).

Composition of melt mol %		Solubility of H_2O (ppm)	
CaO	SiO_2	H	H_2O^*
40	60	58	518
45	55	51	456
50	50	48	429
55	45	87	777

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of Ar + H_2O at near one atm. and were quenched.

The solubility of H_2O was determined by the method described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

analysis of H_2:
δ(ppm)/(ppm) = ± 0.05 (authors)

REFERENCES:

1. Obst, K.-H.; Malissa, H.
Arch. Eisenhuttenwes. 1959, 30, 601 - 603.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Strontium oxide; SrO; [1314-11-0]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Russell, L. E.

J. Soc. Glass Tech. 1957, 41, 304T 317T.

VARIABLES:

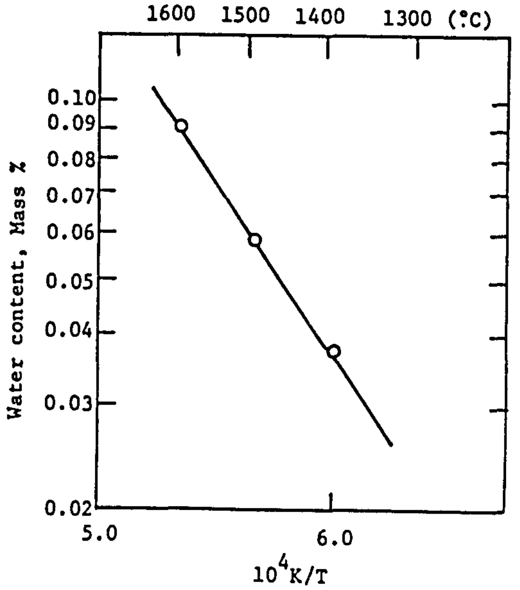
T/K: 1670 - 1870
H_2O P/ kPa= 101.3 (760 mmHg)
mol ratio n_2/n_3 = 0.5

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in $SrO.2SiO_2$ melts as a function of reciprocal temperature in the temperature range 1660 - 1870 K, and in graphical form only.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The stream of O_2 + H_2O at a pressure near one atm. was bubbled up through the melt in a mullite tube. The determination of the solubility was carried out by the gas purging method with dried O_2.
(Although no details on the partial pressure of H_2O bubbled were given, the solubility data shown are coresponding to that at P_{H_2O} = 1 atm.)

SOURCE AND PURITY OF MATERIALS:

The samples were made by melting high purity sand and analytical reagent grade strontium carbonate.

ESTIMATED ERROR:

δ(ppm)/(ppm): within ± 0.10 (author)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Barium oxide; BaO;
[1304-28-5]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Russell, L. E.

J. Soc. Glass Tech. 1957, **41**, 304T - 317T.

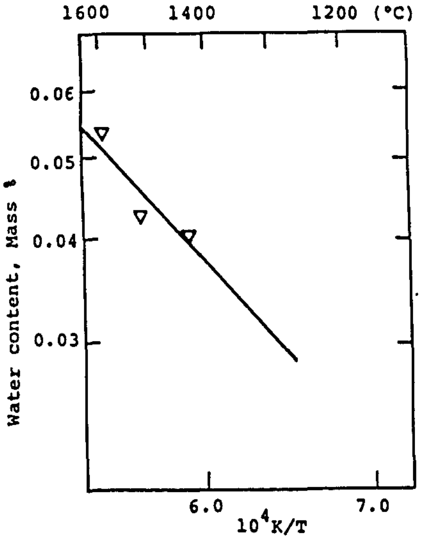
VARIABLES: T/K: 1630 - 1780
H_2O P/kPa = 101.3 (760 mmHg)
Mol ratio n_2/n_3 = 0.5

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The author reported the solubility of H_2O in $BaO.2SiO_2$ melts as a function of reciprocal temperature in the temperature range 1360 - 1780 K, and in graphical form only.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The stream of O_2 + H_2O at a total pressure near 1 atm. was bubbled up through the melt in a mullite tube. The determination of the solubility was carried out by the gas purging method with dried O_2 (Although no details about the partial pressure of H_2O were given the solubility data shown are corresponding to that at P_{H_2O} = 1 atm.)

SOURCE AND PURITY OF MATERIALS:

The samples were made by melting high purity sand and analytical reagent grade barium carbonate.

ESTIMATED ERROR:

δ(ppm)/(ppm): within ± 0.01 (author)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Iron oxide; FeO; [1345-25-1]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.

Trans. Met. Soc. AIME 1963, 227, 492 - 500.

VARIABLES:

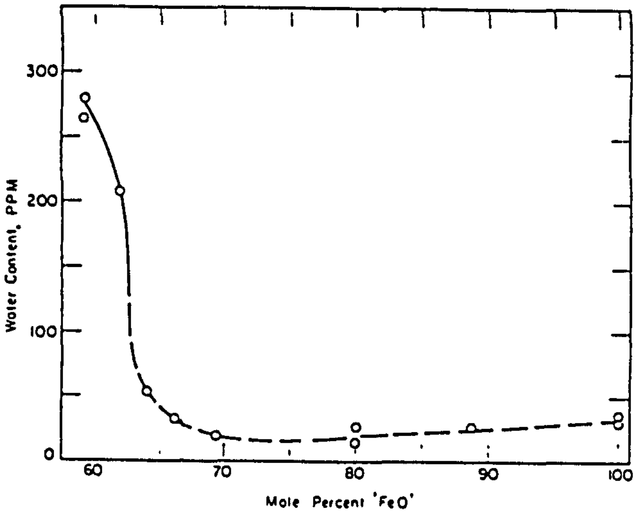
T/K = 1673
H_2O P/kPa = 19.5 (146 mmHg)
mol% FeO: 59 - 100

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in "FeO"-SiO_2 melts as a function of FeO concentration at 1400°C and at P_{H_2O} = 146 mmHg in graphical form only.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Silicates in Armco iron crucibles were equilibrated with the stream of N_2 + H_2 + H_2O at nearly one atm., and were quenched. The solubility of H_2O was determined by the method of analysis described in ref. 1. Vacuum fusion technique was applied to the sample wrapped in Al foil and evolved H_2 was analyzed by a thermal conductivity cell.

SOURCE AND PURITY OF MATERIALS:

The silicates were prepared by mixing together the purest available constituents.
SiO_2: Brazilian rock quartz.
FeO: Armco iron crucibles were used under H_2O - H_2 mixtures to contain FeO in the silicate melts.

ESTIMATED ERROR:

Although not described in the original paper it is estimated to be similar to that in ref. 1:
$\delta(\text{ppm})/(\text{ppm}) = \pm 0.05$ (M. S.)

REFERENCES:

1. Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J.

Trans. Met. Soc. AIME 1956, 206, 1568 - 1576.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Iron oxide; FeO; [1345-25-1] (3) Silica; SiO_2; [7631-86-9]	Wahlster, M.; Reichel, H.-H. **Arch. Eisenhuttenwes.** 1969, **40**, 19 - 25.
VARIABLES: $T/K = 1873$ H_2O P/ kPa = 101.3 (760 mmHg) mol% FeO = 55 - 100	**PREPARED BY:** M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various FeO-SiO_2 melts at 1873 K and at P_{H_2O} = 101.3 kPa (actual measurements were carried out at P_{H_2O} = 31.2 kPa.).

Composition of Melt mol %		Solubility of H_2O ppm	
FeO	SiO_2	H	H_2O^*
55	45	50	447
68	32	40	357
73	27	34	304
80	20	23	206
90	10	13	116
100	0	2	18

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of Ar + H_2O at nearly one atm. and were quenched.

The solubility of H_2O was determined by the method described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

analysis of hydrogen
$\delta(\text{ppm})/(\text{ppm}) = \pm 0.05$ (authors)

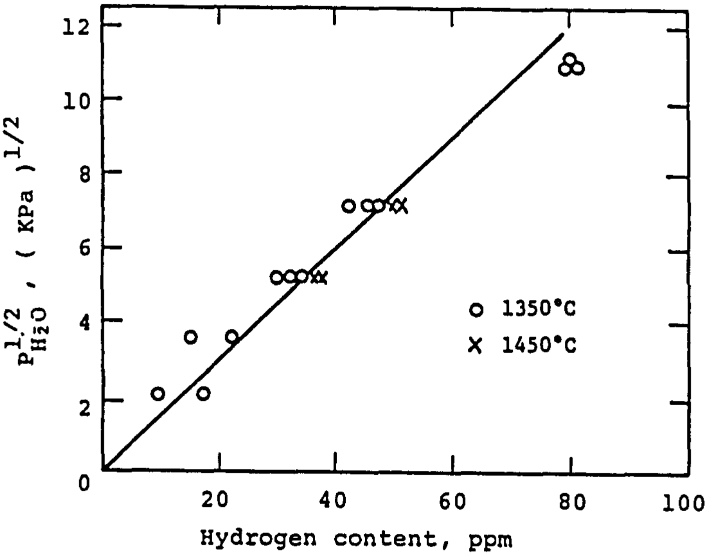
REFERENCES:

1. Obst, K.-H.; Malissa, H.
Arch. Eisenhuttenwes. 1959, **30**, 601 - 603.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Manganese oxide; MnO; [1344-70-3] (3) Silica; SiO_2; [7631-86-9]	Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J. J. Metals <u>1956</u>, 8, 1568 - 1576.
VARIABLES: T/K = 1623 & 1723 H_2O P/kPa: 30 - 101.3 mol ratio n_2/n_3 = 1.38	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H in 62% MnO - 38% SiO2 (mass%) melts as a function of $P_{H_2O}^{1/2}$ at 1350 and 1450°C, and only in graphical form.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A slag in a Pt crucible was equilibrated with the stream of nearly one atm. of N_2 + H_2O and was quenched by lowering the crucible into either Hg or H_2O. The solubility of H_2O was analyzed as H content by applying the vacuum fusion technique to the sample wrapped with Al foil at about 1600°C.	The slags were prepared by mixing the chemically pure components. The slags were dark brown in color, presumably due to the presence of Mn^{3+} ions. However, the effect of Mn^{3+} on the solubility of H_2O was considered to be small.
	ESTIMATED ERROR: $\delta(ppm)/(ppm) = \pm 0.048$ (authors)
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Cobalt oxide; CoO;
[1307-96-6]
(3) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.

Trans. Met. Soc. AIME 1963, 227, 492 - 500.

VARIABLES:

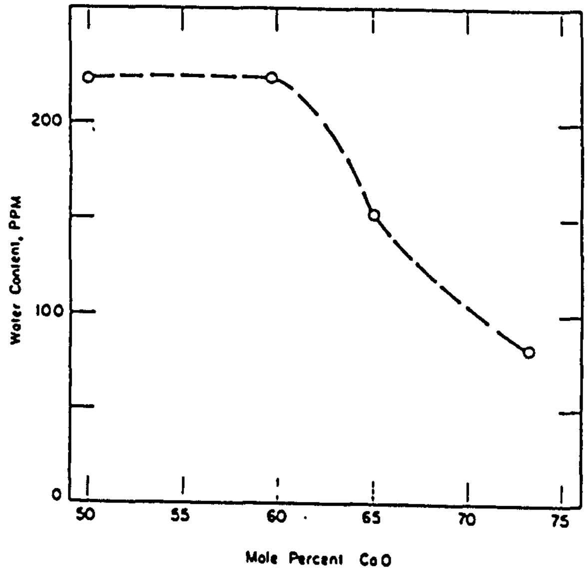
T/K = 1773
H_2O P/ kPa= 19.5 (146 mmHg)
mol% CoO: 50 - 73

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in CoO-SiO_2 melts as a function of mol% of CoO at 1500°C and P_{H_2O} = 146 mmHg in graphical form only.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of N_2 + H_2O at near one atm., and were quenched.

The solubility of H_2O was determined by the method of analysis described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

The silicates were prepared by mixing together the purest available constituents.
SiO_2: Brazilian rock quartz
CoO: Thermal decomposition of carbonate.

ESTIMATED ERROR:

Although not described in the original paper, it is estimated to be similar to that in ref. 1 $\delta(\text{ppm})/(\text{ppm}) = \pm 0.05$ (M.S.)

REFERENCES:

1. Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J.

Trans. Met. Soc. AIME 1956, 206, 1568 - 1576.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Silica; SiO_2; [7631-86-9]
(3) Zinc oxide; ZnO; [1314-13-2]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.

Trans. Met. Soc. AIME 1963, **227,** 492 - 500.

VARIABLES:

mol% ZnO = 44 - 72.5
H_2O P/kPa = 19.5 (146 mmHg)
T/K = 1796, 1835, 1871, 1925

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various SiO_2-ZnO melts as a function of mol% of ZnO at P_{H_2O}=146 mmHg (fig. 1) and the temperature effect on the solubility (fig. 2),^{2}in graphical form only.

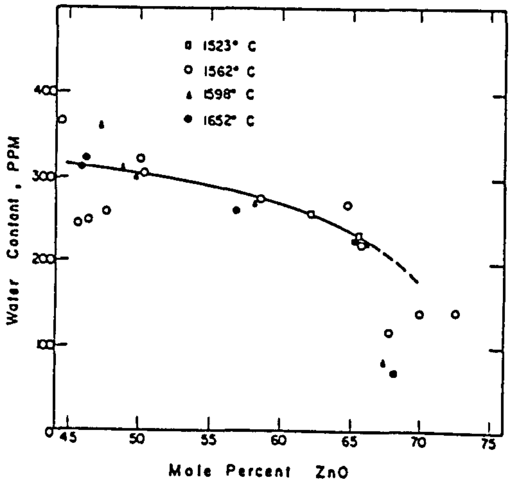


Fig. 1 Solubility of H_2O in SiO_2 -ZnO melts as a function of mol% ZnO

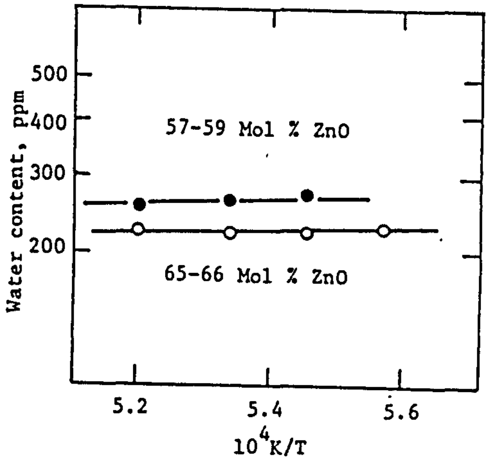


Fig. 2 Solubility of H_2O in SiO_2-ZnO melts as a function of reciprocal temperature

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of N_2 + H_2O at nearly one atm., and were quenched.

The solubility of H_2O was determined by the method of analysis described in ref.1.

SOURCE AND PURITY OF MATERIALS:

The silicates were prepared by mixing together the purest available constituents.

SiO_2: Brazilian rock quartz
ZnO: Reagent grade chemicals

ESTIMATED ERROR:

Not described in the paper, but is estimated to be similar to that in ref. 1; δ(ppm)/(ppm) = ± 0.05 (M. S)

REFERENCES:

1. Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J.

   Trans. Met. Soc. AIME 1956, **206,** 1568 - 1576.

COMPONENTS:

(1) Water; H_2O [7732-18-5]
Silicate melt components:
(2) Calcium oxide; CaO [1305-78-8]
(3) Lithium oxide; Li_2O [12057-24-8]
(4) Silica; SiO_2 [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.
Trans. Met. Soc. AIME, 1963, 227, 492 - 500.

VARIABLES: T/K : 1573, 1673
H_2O P/kPa : 2.1(16 mmHg) - 19.5(146mm Hg)
Mol % (Li_2O + CaO) : 26 - 70

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - Li_2O - SiO_2 melts as the function of mol% (CaO + Li_2O) at 1300°C and 1400°C (fig. 1, 2) and of square root of H_2O pressures at 1300°C (fig. 3), in graphical form only.

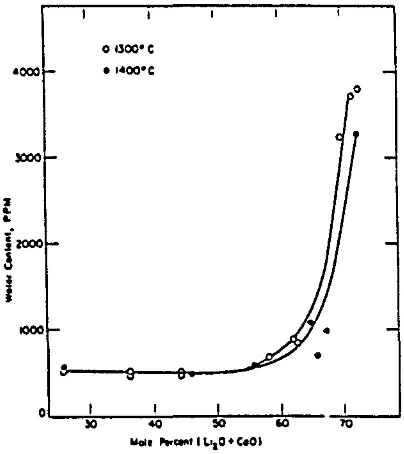


Fig. 1 - Solubility of water in Li_2O-CaO-SiO_2 melts as function of mole pct base. Pct Li_2O approximately constant. p_{H_2O} = 146 mm Hg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of N_2 + H_2O at near one atm., and were quenched.

The solubility of H_2O was determined by the method of analysis described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

The silicates were prepared by mixing together the purest available constituents.

SiO_2: Brazilian rock quartz

CaO, Li_2O: Made by thermal decomposition of carbonates.

ESTIMATED ERROR:

Not described, but it is estimated to be similar to that in ref. 1.
δ(ppm)/(ppm) ± 0.05 (M. S.)

REFERENCES:

1. Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J.

Trans. Met. Soc. AIME 1966, 206, 1568 - 1576.

COMPONENTS:

(1) Water; H_2O [7732-18-5]
Silicate melt components:
(2) Calcium oxide; CaO [1305-78-8]
(3) Lithium oxide; Li_2O [12057-24-8]
(4) Silica; SiO_2 [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.
Trans. Met. Soc. AIME, 1963, 227, 492 - 500.

VARIABLES:

T/K : 1673
H_2O P/kPa : 19.5(146 mmHg)
Mol % (Li_2O + CaO) : 45 - 65

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued.

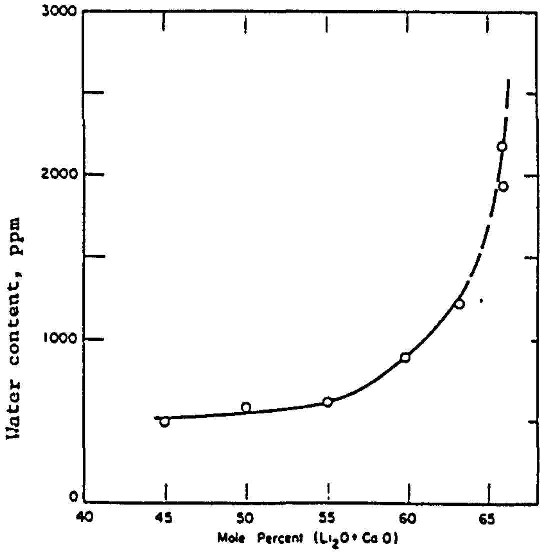


Fig. 2 - Solubility of water in Li_2O-CaO-SiO_2 melts as function of mole pct base. Pct CaO constant. p_{H_2O} = 146 mm Hg. Temperature-1400°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O [7732-18-5]
Silicate melt components:
(2) Calcium oxide; CaO [1305-78-8]
(3) Lithium oxide; Li_2O [12057-24-8]
(4) Silica; SiO_2 [7631-86-9]

ORIGINAL MEASUREMENTS:

Uys, J. M.; King, T. B.
Trans. Met. Soc. AIME, 1963, 227, 492 - 500.

VARIABLES:

T/K : 1573
H_2O P/kPa : 2.1 - 19.5
Mol % Si_2O : 28.9 - 46.9

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued.

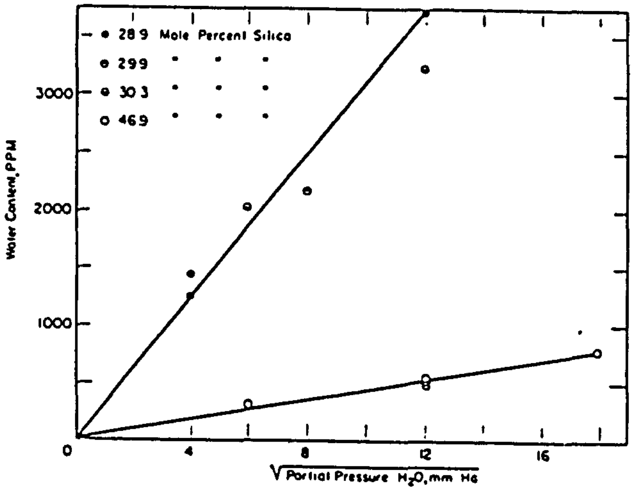


Fig. 3 - Solubility of water in Li_2O-CaO-SiO_2 melts as a function of p_{H_2O}. Temperature-1300°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Lithium oxide; Li_2O; [12057-24-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron & Steel Proc. of the Int. Symp. on Met. Chem. - Appl. on Ferrous Met. Univ. Sheffield, 19 - 21 July 1971, The Iron & Steel Inst., London, UK, 1973, pp. 28 - 30.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% Li_2O = 17.2 - 42.5
mol ratio = n_2/n_4 = 0.26 - 1.84

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - Li_2O - SiO_2 melts at 1450°C in graphical form. The original data were provided by the authors.

mol%			mole ratio	ppm(mass/mass)
CaO	Li_2O	SiO_2	CaO/SiO_2	H_2O
27.0	17.2	55.8	0.49	402
31.1	17.4	51.5	0.60	371
33.3	22.3	44.5	0.75	443
41.9	18.9	39.2	1.07	644
11.7	27.2	61.1	0.63	516
14.1	30.1	55.8	0.25	479
22.3	27.4	50.2	0.45	461
29.0	28.1	42.9	0.68	555
37.3	27.2	35.5	1.05	1125
10.4	35.8	53.9	0.80	528
13.5	34.8	51.7	0.26	512
20.3	36.7	43.0	1.26	558
24.7	35.4	40.0	1.43	705
29.4	34.3	36.3	0.81	1125
9.5	42.1	48.4	0.91	720
12.0	42.5	45.5	1.03	618
18.4	41.2	40.3	1.30	860

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the Ar + H_2O stream at nearly one atm., and was quenched.

H_2O in a sample was measured as H_2 volumetrically by a micro-Orsat gas analyzer after reducing with Al at 1550 - 1600°C.

SOURCE AND PURITY OF MATERIALS:

CaO, LiO_2: Reagent grade chemicals
SiO_2: Transparent high purity silica was washed and cleaned (over 99.9%)

ESTIMATED ERROR:

analysis of H_2:
$\delta(\text{ppm})/(\text{ppm}) = \pm 0.06$ (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1966, **6**, 225 - 232.
2. Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Ibid.** 1969, **9**, 189 - 195.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; Cao; [1305-78-8]
(3) Lithium oxide; Li_2O; [12057-24-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron & Steel Proc. of the Int. Symp. on Met. Chem. - Appl. on Ferrous Met. Univ. Sheffield, 19 - 21 July 1971, The Iron & Steel Inst., London, UK, 1973, pp. 28 - 30.

VARIABLES:

$T/K = 1823$
H_2O $P/kPa = 38.5$ (289 mmHg)
mol% $Li_2O = 17.2 - 42.5$
mol ratio $n_2/n_4 = 0.26 - 1.84$

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

mol%			mole ratio	ppm(mass/mass)
CaO	Li_2O	SiO_2	CaO/SiO_2	H_2O
19.1	39.6	41.3	1.25	911
21.0	41.5	37.5	1.47	1033
22.0	41.5	36.5	1.53	1260
26.2	41.1	32.6	1.84	1999

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Lithium oxide; Li_2O; [12057-24-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron & Steel Proc. of the Int. Symp. on Met. Chem. - Appl. on Ferrous Met. Univ. Sheffield, 19 - 21 July 1971, The Iron & Steel Inst., London, UK, 1973, pp. 28 - 30.

VARIABLES:

$T/K = 1823$
H_2O P/ kPa = 38.5 (289 mmHg)
mol% Li_2O = 17.2 - 42.5
mol ratio n_2/n_4 = 0.26 - 1.84

PREPARED BY:

M. Shinmei

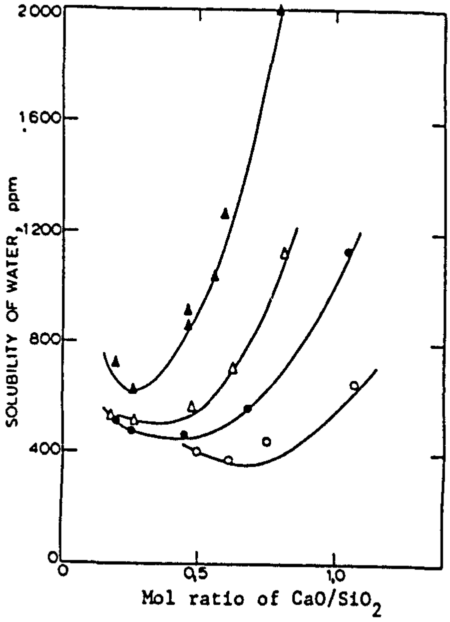
EXPERIMENTAL VALUES: continued

Fig. 1 Solubility of water in CaO - Li_2O - SiO_2 melts as a function of CaO/SiO_2.

	mass % Li_2O	mol% Li_2O
-○-	10	17.5
-●-	15	27.5
-△-	20	35
-▲-	25	41.5

P_{H_2O} = 188 mmHg

Temp. = 1450°C



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Sodium oxide; Na_2O; [1313-59-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

VARIABLES:

T/K = 1573
H_2O P/kPa = 12.3-58.0 (92.5-435 mmHg)
mass% Na_2O = 15.0
mass ratio CaO/SiO_2 = 0.417

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors measured the solubility of H in 60% SiO_2 - 25% CaO - 15% Na_2O (mass) at 1300°C under water vapor pressure 92.5 mmHg - 435 mmHg and confirmed the linear relationship between the solubility and $P_{H_2O}^{1/2}$. The compiler converted the original solubility, expressed in ppm of H, to of H_2O.

P_{H_2O} kPa	P_{H_2O} mmHg	ppm (mass/mass) [H]	ppm (mass/mass) [H_2O]	P_{H_2O} kPa	P_{H_2O} mmHg	ppm (mass/mass) [H]	ppm (mass/mass) [H_2O]
12.33	92.5	26	232	38.53	289	47.5	424
12.33	92.5	26	232	38.53	289	45.5	407
19.87	149	32	286	47.33	355	51	456
19.87	149	30.5	273	47.33	355	46.5	416
31.20	234	37.5	335	47.33	355	51	456
31.20	234	42	375	58.00	435	51	456
31.20	234	42	375	58.00	435	56	500
38.53	289	46.0	411	58.00	435	61	545
				58.00	435	63.5	567

The compiler fitted the data for [H_2O, ppm] by least squares to [H_2O, ppm (mass/mass)] = 66.9 $P_{H_2O}^{1/2}$, (δ=26.5), where P_{H_2O} is expressed in kPa and δ is the standard dev. of the precision of the least square fit.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in the sample was reduced to H_2 by Al at 1550 - 1600°C, and H_2 was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: Made by thermal decomposition of reagent grade carbonate of over 99.5% at 900°C
Na_2O: Reagent grade chemical (over 99.5%)
SiO_2: Ground quartz (over 99.5%)

ESTIMATED ERROR:

Analysis of H_2:
δ(ppm)/(ppm) = ± 0.10 (authors)

REFERENCES:

1. Fuwa, T.; Ban-ya, S.; Fukushima, T. **Report of the 19th Committee of the Japan Society for Promotion of Science, No. 7834,** May 1965.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Sodium oxide; Na_2O;
[1313-59-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of 19th Committee of the Japan Society for the Promotion of Science No. 9286, May 1971.

VARIABLES:
T/K = 1723
H_2O P/ kPa = 25.1 (188 mmHg)
mol% Na_2O = 10.2 - 25.4
mol ratio n_2/n_4 = 0.27 - 1.10

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - Na_2O - SiO_2 melts at 1450°C under the vapor pressure of H_2O at 188 mmHg.

mol%			mole ratio	ppm
CaO	Na_2O	SiO_2	CaO/SiO_2	H_2O
21.7	11.2	67.1	0.32	251
28.3	10.4	61.8	0.46	247
31.4	13.3	55.9	0.56	267
33.7	10.7	55.6	0.61	257
37.4	11.3	51.3	0.73	302
39.8	10.7	49.5	0.80	328
46.8	10.2	43.0	1.09	603
22.7	16.2	61.1	0.37	339
26.9	16.4	56.7	0.76	296
35.8	14.3	49.9	0.72	323
44.2	15.6	40.2	1.10	731
16.8	21.6	61.6	0.27	487
17.4	19.4	63.3	0.28	389
21.8	19.1	59.1	0.37	404
26.1	20.4	53.5	0.49	401
30.3	20.3	49.3	0.62	466
32.0	18.3	49.7	0.64	687

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream at nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced to H_2 by Al at 1550 - 1600°C, which was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: Thermal decomposition of reagent grade carbonate (over 99.5%) at 900°C
Na_2O: Reagent grade chemical (over 99.5%)
SiO_2: Ground quartz (99.9%)

ESTIMATED ERROR:

Analysis of H_2O:
δ(ppm)/(ppm) < ± 0.06 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1966, 6, 225 - 232.
2. Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Ibid.** 1969, 9, 189 - 195.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Sodium oxide; Na_2O; [1313-59-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for the Promotion of Science No. 9286, May 1971.

VARIABLES:

T/K = 1723
H_2O P/kPa = 25.1 (188 mmHg)
mol% Na_2O = 10.2 - 25.4
mol ratio n_2/n_3 = 0.27 - 1.10

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

mol%			mole ratio	ppm
CaO	Na_2O	SiO_2	CaO/SiO_2	H_2O
37.2	20.7	42.2	0.88	693
16.2	25.2	58.6	0.28	684
21.1	24.3	54.6	0.39	547
23.9	25.4	50.7	0.47	579
27.8	24.6	47.6	0.58	684
32.1	24.0	43.9	0.73	889

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Sodium oxide; Na_2O; [1313-59-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for the Promotion of Science No. 9286, May 1971.

VARIABLES:

T/K = 1723
H_2O P/ kPa = 25.1 (188 mmHg)
mol% Na_2O = 10.2 - 25.4
mol ratio n_2/n_3 = 0.27 - 1.10

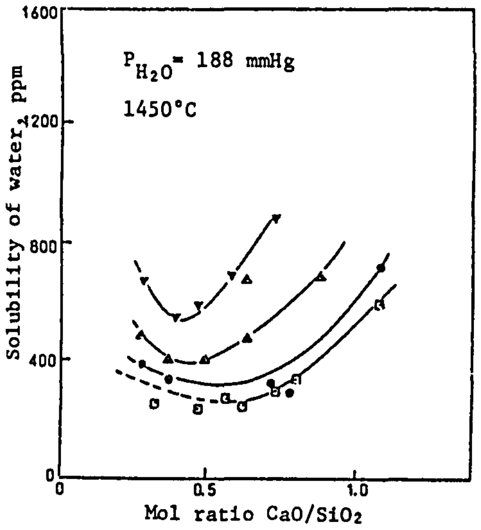
PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

Fig. 1, Solubility of water in CaO - Na_2O - SiO_2 melts as a function of mol ratio CaO/SiO_2 at 1450°C and P_{H_2O} = 25.1 kPa.

Na_2O	Mass%	Mol%
-□-	10	11
-●-	15	16
-△-	20	21
-▼-	25	25



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732- 18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Potassium oxide; K_2O; [12136-45-7]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for Promotion of Science, No. 9286 May 1971.

VARIABLES:

$T/K = 1723$
H_2O P/kPa = 38.5 (289 mmHg)
mol% K_2O = 6.1 - 17.8
mol ratio n_2/n_4 = 0.44 - 1.11

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - K_2O - SiO_2 melts at 1450°C and at 289 mmHg of H_2O in graphical form. The original data were provided by the authors.

mole %			mole ratio	ppm(mass/mass)
CaO	K_2O	SiO_2	CaO/SiO_2	H_2O
33.9	6.7	59.4	0.57	358
34.6	7.0	58.4	0.59	355
37.7	7.5	54.8	0.69	283
41.2	6.8	51.9	0.79	374
49.1	6.7	44.2	1.11	542
49.3	6.1	44.6	1.11	527
27.5	10.5	62.0	0.44	439
32.1	11.2	56.7	0.57	388
32.8	10.1	57.1	0.58	448
34.5	9.4	56.1	0.62	441
35.0	9.9	55.1	0.64	379
36.2	10.6	53.3	0.68	428
36.7	10.3	53.1	0.69	493
38.2	8.9	52.9	0.74	437
40.5	10.0	49.5	0.82	402
41.4	9.7	48.9	0.85	455

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream at near one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced to H_2 by Al at 1500 - 1600°C, and was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%) at 900°C
K_2O: Reagent grade chemical (over 99.5%)
SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

Analysis of H_2O:
$\delta(ppm)/(ppm) = \pm\ 0.06$ (authors)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Potassium oxide; K_2O; [12136-45-7]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for Promotion of Science, No. 9286, May 1971.

VARIABLES: $T/K = 1723$ (1450°C)
H_2O $P/kPa = 38.5$ (289 mmHg)
mol% K_2O = 6.1 - 17.8
mol ratio n_2/n_4 = 0.44 - 1.11

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

mole %			mole ratio	ppm(mass/mass)
CaO	K_2O	SiO_2	CaO/SiO_2	H_2O
41.8	8.9	49.3	0.85	487
46.6	9.0	44.4	1.05	515
26.9	14.6	58.5	0.46	502
27.1	13.7	59.2	0.46	475
27.9	13.4	58.6	0.48	554
32.4	13.5	54.1	0.60	529
32.6	13.9	53.6	0.61	517
34.3	12.8	52.9	0.65	527
35.1	13.7	50.8	0.69	617
39.1	13.4	47.5	0.82	633
39.8	13.0	47.1	0.85	509
41.2	12.4	46.4	0.89	770
41.4	13.4	45.2	0.92	775
42.8	13.1	44.1	0.97	645
25.7	17.5	55.9	0.46	603
26.4	16.7	56.9	0.46	615
30.5	16.4	53.1	0.57	613
31.6	15.7	53.3	0.59	655
33.4	16.7	49.9	0.67	754
33.5	17.8	48.7	0.69	773
34.0	16.1	49.9	0.68	730
34.4	16.5	49.1	0.70	732
37.8	17.2	45.0	0.84	978
39.0	17.1	44.0	0.89	1156
39.8	15.7	44.5	0.89	944
41.2	15.2	43.6	0.95	870

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Potassium oxide; K_2O; [121-36-45-7]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y. Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for Promotion of Science, No. 9286, May 1971.

VARIABLES:

T/K = 1723
H_2O P/kPa = 38.5 (289 mmHg)
mol% K_2O = 6.1 - 17.8
mol ratio n_2/n_4 = 0.44 - 1.11

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

K_2O	mass%	mol%
—□—	10	7
—●—	15	10
—△—	20	13
—▼—	25	16

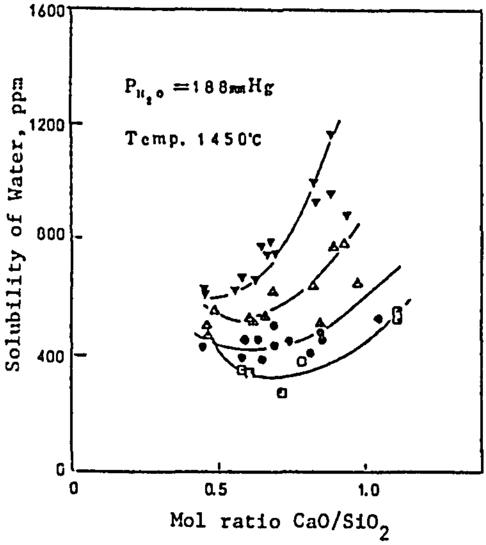


fig. 1, Solubility of water in CaO - K_2O - SiO_2 melts as a function of mol ratio CaO/SiO_2 at 1450°C and P_{H_2O} = 38.5 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Magnesium oxide; MgO; [1309-48-4]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1970, 10, 29 - 35.

VARIABLES: T/K = 1673 - 1873
H_2O P/kPa = 38.5 (289 mmHg)
mol% MgO = 7.0 - 36
mol ratio n_2/n_4 = 0.16 - 1.2

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - MgO - SiO_2 melts at 1400, 1450, 1500, 1550 and 1600°C under the vapor pressure of H_2O at 289 mmHg. The solubility data at 1550°C is shown in Table 1 and in Figs. 1 - 2. The effect of temperature on the solubility of H_2O from 1400 to 1600°C is shown in Table 2 and Fig. 3. Some misprints in the original report were corrected by the compiler by correspondence with the authors.

Table 1
Solubility of H_2O at 38.5 P/KPa (289 mmHg) and at 1823 K (1550°C)

mass %			mol%			mole ratio		ppm(mass/mass)
CaO	MgO	SiO_2	CaO	MgO	SiO_2	CaO/SiO_2	$\frac{(CaO+MgO)}{SiO_2}$	H_2O
30.5	5.0	64.5	31.2	7.1	61.7	0.51	0.62	407
37.8	5.0	57.2	38.5	7.1	54.4	0.71	0.84	369
43.6	5.0	51.4	44.2	7.1	48.7	0.91	1.05	363
49.7	5.7	44.5	50.1	8.0	41.9	1.20	1.39	492
24.9	9.6	65.5	25.1	13.4	61.5	0.41	0.63	409
27.5	10.5	62.0	27.5	14.6	57.9	0.47	0.73	375
30.4	10.6	59.0	30.3	14.7	55.0	0.55	0.82	367
32.1	10.8	57.1	32.0	14.9	53.1	0.60	0.88	528
35.1	10.8	54.1	34.9	14.9	50.2	0.70	0.99	402

cont'd

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream at near one atm., and was quenched in a water cooled Cu mold.

H_2O in the quenched sample was reduced to H_2 by Al at 1550 - 1600°C, and H_2 was measured volumetrically by using a micro-Orsat gas analyzer. (refs. 1, 2)

SOURCE AND PURITY OF MATERIALS:

CaO and MgO: Reagent grade chemicals
SiO_2: Transparent high purity silica was washed and cleaned (over 99.9%).

ESTIMATED ERROR:

analysis of H_2:
δ(ppm)/(ppm) = < ± 0.06 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1966, 6, 225 - 232.
2. Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Ibid.** 1969, 9, 189 - 195.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Magnesium oxide; MgO;
[1309-48-4]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1970, 10, 29 - 35.

VARIABLES: T/K = 1673 - 1873
H_2O P/kPa = 38.5 (289 mmHg)
mol% MgO = 7.0 - 36
mol ratio n_2/n_4 = 0.16 - 1.2

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

mass %			mol%			mole ratio		ppm(mass/mass)
CaO	MgO	SiO_2	CaO	MgO	SiO_2	CaO/SiO_2	$\frac{(CaO+MgO)}{SiO_2}$	H_2O
42.9	10.0	47.1	42.6	13.8	43.6	0.98	1.29	465
38.7	11.5	49.8	38.3	15.8	45.9	0.83	1.18	440
39.4	12.2	48.4	38.8	16.7	44.5	0.81	1.25	390
19.3	15.0	65.7	19.0	20.5	60.5	0.31	0.65	426
23.2	14.7	62.1	22.8	20.1	57.1	0.40	0.75	426
23.3	15.0	61.7	22.9	20.5	56.6	0.40	0.77	403
25.8	15.3	58.9	25.3	20.8	53.9	0.47	0.86	420
29.9	15.4	54.7	29.2	20.9	49.9	0.59	1.00	390
34.2	15.1	50.9	33.3	20.4	46.3	0.72	1.16	461
41.1	15.8	43.1	39.8	21.3	38.9	1.02	1.57	616
10.1	21.3	68.6	9.8	28.5	61.7	0.16	0.62	522
16.0	20.0	64.0	15.5	26.8	57.7	0.27	0.73	468
22.8	20.0	57.2	21.9	26.7	51.4	0.44	0.95	451
29.7	21.3	48.9	28.3	28.2	43.5	0.65	1.30	474
38.8	20.1	41.1	36.9	26.6	36.5	1.01	1.74	641
15.7	27.7	57.0	14.6	35.9	49.5	0.29	1.02	469

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Magnesium oxide; MgO; [1309-48-4]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1970, 10, 29 - 35.

VARIABLES: T/K = 1673 - 1873
H_2O P/kPa = 38.5 (289 mmHg)
mol% MgO = 7.0 - 36
mol ratio n_2/n_4 = 0.16 - 1.2

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

Table 2
Effect of Temperature on the Solubility of H_2O at 38.5 P/kPa (289 mmHg)

Temp	mass %			mol%			mole ratio	ppm(mass/mass)
(°C)	CaO	MgO	SiO_2	CaO	MgO	SiO_2	$\frac{(CaO+MgO)}{SiO_2}$	H_2O
1400	30.8	15.6	53.6	30.0	21.2	48.8	1.05	356
1450	22.8	15.4	61.8	22.4	21.0	56.6	0.77	404
	30.7	14.8	54.6	30.0	20.1	49.9	1.00	349
	36.4	16.0	47.7	35.3	21.6	43.1	1.32	394
1500	21.2	13.9	64.9	21.0	19.1	59.9	0.67	409
	30.5	15.1	54.3	29.9	20.5	49.6	1.01	436
	36.9	14.7	47.4	36.3	20.1	43.6	1.32	417
1550	29.9	15.4	54.7	29.2	20.9	49.9	1.00	420
	23.3	15.0	61.7	22.9	20.5	56.6	0.77	403
	39.4	12.2	47.8	39.0	16.8	44.2	1.26	390
1600	15.9	34.0	50.1	14.5	43.0	42.5	1.35	521
	30.1	14.2	55.7	29.6	19.4	51.0	0.96	471
	36.5	16.2	47.4	35.4	21.8	42.8	1.34	495

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Magnesium oxide; MgO; [1309-48-4]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1970, 10, 29 - 35.

VARIABLES: T/K = 1823
H_2O P/ kPa= 38.5 (289 mmHg)
mol% MgO = 7.0 - 36
mol ratio n_2/n_4 = 0.16 - 1.2

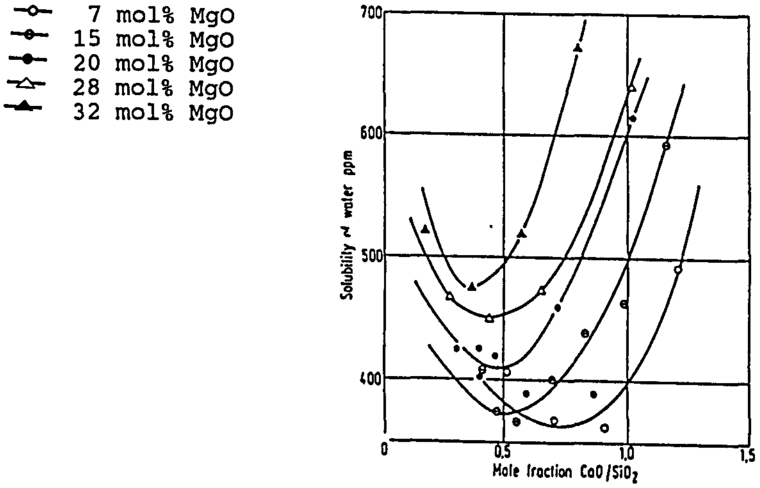
PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

Fig. 1 Solubility of water in CaO - MgO - SiO_2 melts at 1550°C and P_{H_2O} = 38.5 kPa as a function of mole ratio CaO/SiO_2;



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS: (1) Water; H_2O; [7732-18-5] (2) Calcium oxide; CaO; [1305-78-8] (3) Magnesium oxide; MgO; [1309-48-4] (4) Silica; SiO_2; [7631-86-9]	**ORIGINAL MEASUREMENTS:** Iguchi, Y.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1970, 10, 29 - 35.
VARIABLES: T/K = 1823 H_2O P/kPa = 38.5 (289 mmHg) mol% MgO = 7.0 - 36 mol ratio n_2/n_4 = 0.16 - 1.2	**PREPARED BY:** M. Shinmei

EXPERIMENTAL VALUES:

continued

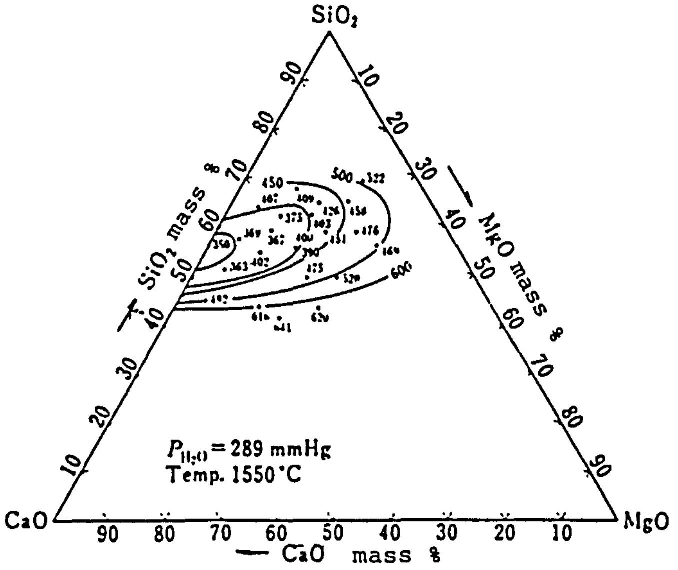


Fig. 2 Iso-solubility lines of water in CaO - MgO - SiO_2 melts at 1550°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	**SOURCE AND PURITY OF MATERIALS:**
	ESTIMATED ERROR:
	REFERENCES:

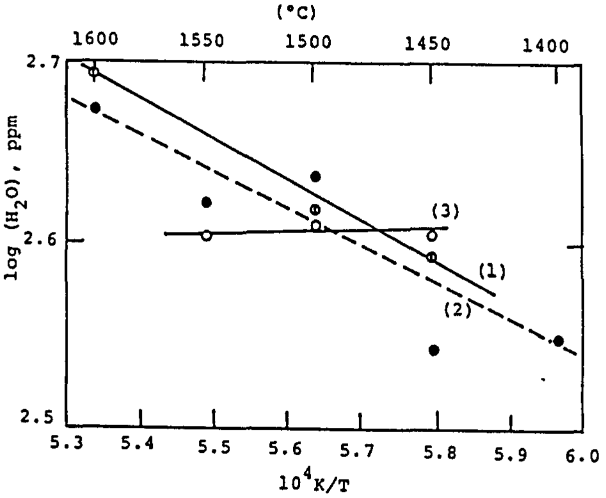
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Calcium oxide; CaO; [1305-78-8] (3) Magnesium oxide; MgO; [1309-48-4] (4) Silica; SiO_2; [7631-86-9]	Iguchi, Y.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** **1970**, **10**, 29 - 35.
VARIABLES: T/K = 1673 - 1873 H_2O P/kPa = 38.5 (289 mmHg) mol% MgO = 7.0 - 36 mol ratio n_2/n_4 = 0.16 - 1.2	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

continued

Fig.3 Effect of temperature on the solubility of water in CaO - MgO - SiO_2 melts at P_{H_2O} = 38.5 kPa ; mol ratio of: (CaO + MgO)/(SiO_2) are:

-⊕- (1) 1.3
-●- (2) 1.0
-○- (3) 0.7



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Magnesium oxide; MgO; [1309-48-4]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Ban-ya, S.; Iguchi, Y.; Yamamoto, S.

Tetsu to Hagane <u>1986</u>, 72, 2210 - 2217.

VARIABLES:

$T/K = 1723$
H_2O P/ kPa = various
$n_2/n_3/n_4$ = various

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the iso-water vapor capacities defined by:

$$\log K' = \log(\text{mass } \% \ H_2O/P^{1/2}_{H_2O})$$

as shown in Fig. 1, where P_{H_2O} is expresed in mm Hg.

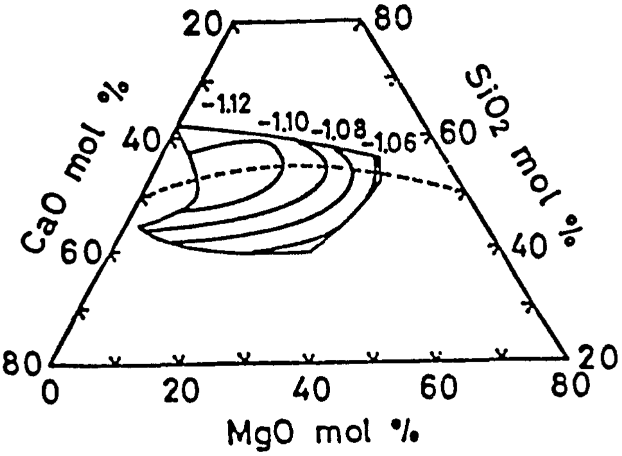


Fig. 1 Iso-water vapor capacity lines in CaO - MgO - SiO_2 melts at 1450°C

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Synthesized slag was equilibrated with water vapor by blowing nearly one atm. Ar + H_2O gas mixture over the melt.

Water contents were determined by the method developed by the authors (1).

SOURCE AND PURITY OF MATERIALS:

CaO: made by fining reagent grade $CaCO_3$
MgO: reagent grade powder
SiO_2: crushed quartz

ESTIMATED ERROR:

No description in the paper but is estimated to be of the same order as in ref. 1.

REFERENCES:

1. Ban-ya, S.; Iguchi, Y.; Nagata, S.

Tetsu to Hagane <u>1985</u>, 71, 55 - 62.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Barium oxide; BaO; [1304-28-5]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, T.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for Promotion of Science No. 9286, May 1971.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
Mol% BaO = 1.9 - 11.8
mol ratio n_3/n_4 = 0.35 - 1.10

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various BaO - CaO - SiO_2 melts at 1550°C under the H_2O vapor pressure at 289 mmHg. The original data were provided by the authors.

mole %			mole ratio	ppm(mass/mass)
BaO	CaO	SiO_2	CaO/SiO_2	H_2O
2.0	34.7	63.3	0.55	324
2.0	40.4	57.7	0.70	337
1.9	46.5	51.6	0.90	335
2.0	50.2	47.8	1.05	344
2.0	51.4	46.6	1.10	354
4.1	29.7	66.2	0.45	326
4.1	34.1	61.9	0.55	316
4.1	37.9	58.0	0.65	318
4.1	39.5	56.5	0.70	296
3.8	42.8	53.4	0.80	315
4.0	42.8	53.2	0.80	309
4.1	45.4	50.5	0.90	294
4.0	47.9	48.0	1.00	364
4.1	47.9	48.0	1.00	354
6.3	31.4	62.3	0.50	314
6.3	37.0	56.7	0.65	292

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with H_2O + Ar stream at nearly one atm., and was quenched in a water cooled Cu mold. H_2O in the quenched sample was reduced to H_2 by Al at 1550 - 1600°C, and was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

BaO: Reagent grade chemical (over 99.9%)
CaO: Decomposition of reagent grade carbonate (over 99.5%) at 900°C
SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

Analysis of Hydrogen,
δ(ppm)/(ppm) = ± 0.04 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1966, **6**, 225 - 232.
2. Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Ibid.** 1969, **9**, 189 - 195.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Barium oxide; BaO; [1304-28-5]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for Promotion of Science No. 9286, May 1971.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% BaO = 1.9 - 11.8
mol ratio n_3/n_4 = 0.35 - 1.10

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

	mole %		mole ratio	ppm(mass/mass)
BaO	CaO	SiO_2	CaO/SiO_2	H_2O
6.2	38.2	55.6	0.70	319
6.3	41.6	52.1	0.80	287
6.3	44.4	49.3	0.90	305
6.3	46.8	46.9	1.00	322
8.9	22.8	68.3	0.35	343
8.5	26.6	64.9	0.42	335
8.7	30.6	60.7	0.50	314
8.7	36.1	55.2	0.65	292
8.6	38.1	53.3	0.72	345
8.7	40.7	50.6	0.80	294
8.7	40.7	50.6	0.80	288
8.6	43.5	47.9	0.91	314
8.6	46.8	44.6	1.05	332
11.8	24.8	63.4	0.40	317
11.4	25.3	63.3	0.40	311
11.4	27.5	61.6	0.45	319
11.7	28.1	60.2	0.47	318
11.3	31.3	57.4	0.55	287
11.4	32.2	56.4	0.58	312
11.3	36.4	52.4	0.70	286
11.2	36.4	52.4	0.70	295
11.3	40.8	47.9	0.85	304
11.2	44.3	44.5	1.00	357
11.2	44.7	44.1	1.02	333

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Barium oxide; BaO; [1304-28-5]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Report of the 19th Committee of the Japan Society for the Promotion of Science No. 9286, May 1971.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% BaO = 1.9- 11.8
mol ratio n_3/n_4 = 0.35 - 1.10

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M. Shinmei

EXPERIMENTAL VALUES:

continued

	BaO	mass%	mol%
1)	-●-	5	2.0
2)	-⊡-	10	4.1
3)	-●-	15	6.3
4)	-△-	20	8.7
5)	-▼-	25	11.4

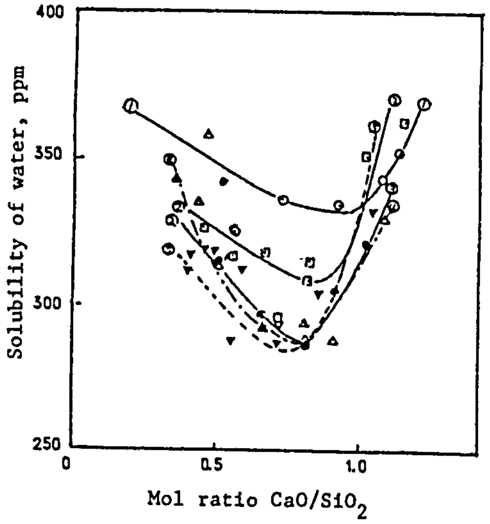


Fig. 1 Solubility of water in BaO - CaO - SiO_2 melts at 1550°C and P_{H_2O} = 38.5 kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silica; SiO_2; [7631-86-9]
(4) Strontium oxide; SrO; [1314-11-0]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron and Steel Proc. of the Intl. Symp. on Met. Chem. - Appl. on Ferrous Met. held at Univ. Sheffield, 19 - 21 July 1971, The Iron and Steel Inst., London, UK, 1973, 28 - 30.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% SrO = 2.8 - 15.8
mol ratio n_2/n_3 = 0.34 - 1.1

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - SiO_2 - SrO melts at 1550°C and at 289 mmHg of H_2O partial pressure in graphical form. The original data were provided by the authors.

mol%			mole ratio	ppm(mass/mass)
CaO	SiO_2	SrO	CaO/SiO_2	H_2O
34.3	62.8	2.9	0.55	379
39.8	57.3	2.8	0.70	334
47.3	49.9	2.9	0.95	305
50.9	46.2	2.8	1.10	311
29.6	64.5	6.0	0.46	367
31.6	62.5	5.9	0.50	350
34.4	59.6	5.9	0.58	364
37.2	56.9	5.9	0.65	338
42.0	52.1	5.9	0.80	311
43.1	51.0	5.9	0.85	325
47.0	47.1	5.9	1.00	327
28.2	62.7	9.1	0.45	332
28.6	62.3	9.1	0.46	340
33.5	57.4	9.1	0.59	310
37.2	53.7	9.2	0.69	305
43.1	47.9	9.0	0.90	329

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the Ar + H_2O stream at nearly one atm., and was quenched.

H_2O in a sample was measured as H_2 volumetrically by a micro-Orsat gas analyzer after reducing with Al at 1550 - 1600°C.

SOURCE AND PURITY OF MATERIALS:

CaO, SrO: Reagent grade chemicals
SiO_2: Transparent high purity SiO_2 was washed and cleaned (over 99.9%)

ESTIMATED ERROR:

Analysis of H_2 :
$\delta(\text{ppm})/(\text{ppm}) = \pm\ 0.06$ (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1966, 6, 225 - 232.
2. Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Ibid.** 1969, 9, 189 - 195.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silica; SiO_2; [7631-86-9]
(4) Strontium oxide; SrO; [1314-11-0]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron and Steel Proc. of the Intl. Symp. on Met. Chem. - Appl. on Ferrous Met. held at Univ. Sheffield, 19 - 21 July 1971, The Iron and Steel Inst., London, UK, 1973, 28 - 30.

VARIABLES:

T/K = 1823
H_2O P/ kPa = 38.5 (289 mmHg)
mol% SrO = 2.8 - 15.8
mol ratio n_2/n_3 = 0.34 - 1.1

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

mol%			mole ratio	ppm(mass/mass)
CaO	SiO_2	SrO	CaO/SiO_2	H_2O
45.5	45.5	9.0	1.00	346
23.0	64.5	12.5	0.34	341
25.0	62.5	12.5	0.40	323
27.6	60.0	12.4	0.46	315
29.3	58.2	12.5	0.50	310
32.0	55.5	12.4	0.65	296
32.9	54.7	12.4	0.60	307
40.3	47.4	12.3	0.85	304
42.7	44.9	12.3	0.95	354
22.4	62.7	14.9	0.36	311
28.2	55.9	15.9	0.50	296
29.8	54.3	15.9	0.55	294
31.6	52.6	15.8	0.60	295
34.5	49.7	15.8	0.70	297
37.4	46.8	15.8	0.80	312
42.1	42.1	15.7	1.00	318

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silica; SiO_2; [7631-86-9]
(4) Strontium oxide; SrO; [1314-11-0]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.
Chem. Met. of Iron and Steel Proc. of the Intl. Symp. on Met. Chem. - Appl. on Ferrous Met. held at Univ. Sheffield, 19 - 21 July 1971, The Iron and Steel Inst., London, UK, 1973, 28 - 30.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% SrO = 2.8 - 15.8
mol ratio n_2/n_3 = 0.34 - 1.1

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

SrO	mass%	mol%
▽	5	2.8
○	10	5.9
●	15	9.1
△	20	12.4
▲	25	15.8

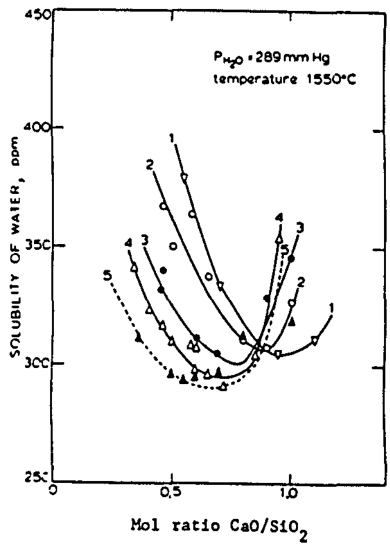


fig. 1, Solubility of water in CaO - SiO_2 - SrO melts as a function of CaO/SiO_2.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Boron oxide; B_2O_3; [1303-86-2]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

VARIABLES:
T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% B_2O_3 = 2.5 - 11.2
mol ratio n_2/n_4 = 0.63

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in ppm of H in various B_2O_3 - CaO - SiO_2 melts at 1500°C and at P_{H_2O} = 289 mmHg in graphical form. The original data are shown in ref. 1[a]

Mass%			Mol %			mol ratio	ppm(mass/mass)	
B_2O_3	CaO	SiO_2	B_2O_3	CaO	SiO_2	CaO/SiO_2	H	H_2O*
3	36.0	61.0	2.5	37.8	59.7	0.63	51	456
5	35.3	59.7	4.3	37.1	58.6	0.63	50	447
10	33.4	56.6	8.5	35.4	56.1	0.63	55	490
10	33.4	56.6	8.5	35.4	56.1	0.63	53	474
13	32.3	54.7	11.2	34.4	54.4	0.63	58	518

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced to H_2 by Al at 1500 - 1600°C, and was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

B_2O_3: Reagent grade chemical (over 90%, impurity except for H_2O was less than 0.1%)
CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%) at 900°C
SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

$\delta(ppm)/(ppm) = \pm 0.08$ (authors)

REFERENCES:

1. Fuwa, T.; Ban-ya, S.; Fukushima, T.
Report of the 19th Committee of the Japan Society for Promotion of Science, No. 7834, May 1965.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Aluminum oxide; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, **9**, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.4 (288 mmHg)
Al_2O_3/mass% = 3.0 - 51.7
mass ratio n_3/n_4 = 0.51 - 8.96

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various Al_2O_3 - CaO - SiO_2 melts at 1550°C in graphical form. The original data were provided by the authors.

mass(%)			mole ratio	ppm(mass/mass)
Al_2O_3	CaO	SiO_2	CaO/SiO_2	H_2O
3.0	53.4	43.6	1.31	468
4.6	35.6	59.4	0.64	318
5.0	41.4	51.9	0.85	397
5.0	52.2	42.8	1.30	485
9.0	33.9	57.0	0.64	316
9.0	45.3	45.3	1.07	419
9.0	49.5	41.9	1.27	524
9.1	39.7	49.5	0.86	371
9.5	37.1	52.9	0.75	369
10.0	49.5	40.5	1.31	533
13.0	47.8	39.2	1.31	525
13.0	50.5	36.5	1.48	595
14.4	37.6	47.1	0.86	366
15.0	27.4	57.6	0.51	307
15.0	46.7	38.3	1.31	533

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with H_2O + Ar stream at near one atm. and were quenched.

The water in quenched samples was reduced to H_2O by Al at 1450 - 1600°C and was determined volumetrically as H_2. (ref. 1)

SOURCE AND PURITY OF MATERIALS:

Al_2O_3: reagent grade chemical (over 99.9%).
CaO: made by thermal decomposition of reagent grade calcium carbonate
SiO_2: high purity quartz (over 99.9%)

ESTIMATED ERROR:

Analysis of H_2: δ(ppm)/(ppm) = ± 0.06 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

   Trans. Iron Steel Inst. Jpn. 1966, **6**, 225 - 232.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Aluminum oxide; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.4 (288 mmHg)
Al_2O_3/mass% = 3.0 - 51.7
mass ratio n_3/n_4 = 0.51 - 8.96

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued.

mass(%) Al_2O_3	 CaO	 SiO_2	mole ratio CaO/SiO_2	ppm(mass/mass) H_2O
15.5	31.4	53.3	0.63	345
18.0	45.1	36.9	1.31	507
18.5	40.0	40.0	1.07	428
19.0	35.2	43.7	0.86	344
19.0	44.0	36.0	1.31	523
19.6	33.5	46.4	0.77	375
19.7	29.8	50.8	0.63	327
24.0	42.0	34.1	1.32	488
24.2	33.0	41.4	0.85	350
25.6	27.7	46.4	0.64	376
28.9	29.2	40.8	0.77	394
29.0	35.0	35.0	1.07	428
29.0	38.5	31.8	1.30	501
29.6	30.9	38.2	0.87	390
29.6	26.2	42.8	1.30	485
31.8	57.4	10.3	5.97	1170
34.0	35.7	28.9	1.32	483
36.7	55.8	7.0	8.54	1520
39.0	32.5	25.5	1.37	501
39.2	26.3	33.2	0.85	399
42.5	50.8	6.1	8.96	1190
44.9	45.9	8.7	5.65	855
51.7	42.6	5.2	8.19	844

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Aluminum oxide; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/ kPa = 38.4 (288 mmHg)
Al_2O_3/mass% = 3.0 51.7
mass ratio n_3/n_4 = 0.51 - 8.96

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

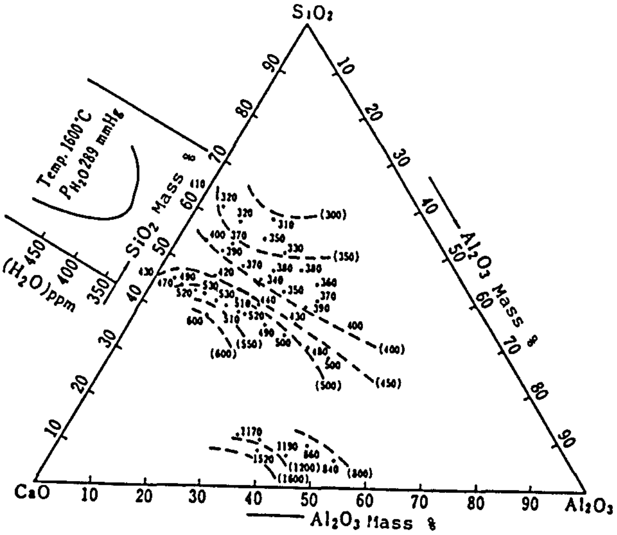


fig. 1 Solubility of H_2O (ppm) in Al_2O_3 - CaO - SiO_2 melts at 1550°C and at P_{H_2O} = 289 mmHg. Dashed lines represent iso-solubility curves.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Ban-ya, S.; Iguchi, Y.; Nagata, S.

Tetsu to Hagane 1985, 71 55 - 62.

VARIABLES:

$T/K = 1673$ K
H_2O P/ kPa = various
$n_2/n_3/n_4$ = various

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the iso-water vapor capacities defined by:

$$\log K' = \log(\text{mass } \% \; H_2O/P^{1/2}_{H_2O})$$

as shown in Fig. 1 for the Al_2O_3 - CaO - SiO_2 melts at 1400°C, where P_{H_2O} is expressed in mm Hg.

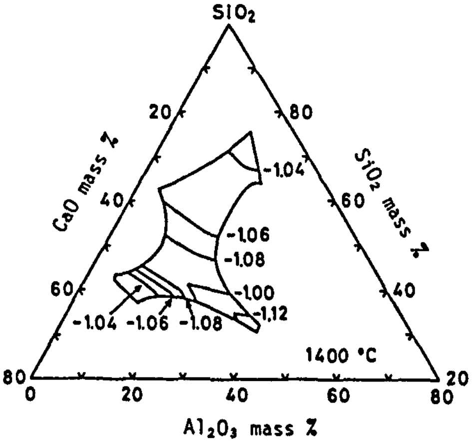


Fig. 1. Iso-contours of water-vapor capacity, log K'.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Synthesized slag melt was equilibrated with water vapor by blowing one atm. of Ar + H_2O gas mixture over the melt.

Water contents were detrmined by the method developed by the authors (1) (vacuum fusion with Al metal).

SOURCE AND PURITY OF MATERIALS:

Al_2O_3: reagent grade alumina powder
CaO: made by fining reagent grade $CaCO_3$
SiO_2: crushed quartz

ESTIMATED ERROR:

δ(ppm)/(ppm) = within 0.05 (Authors)

REFERENCES:

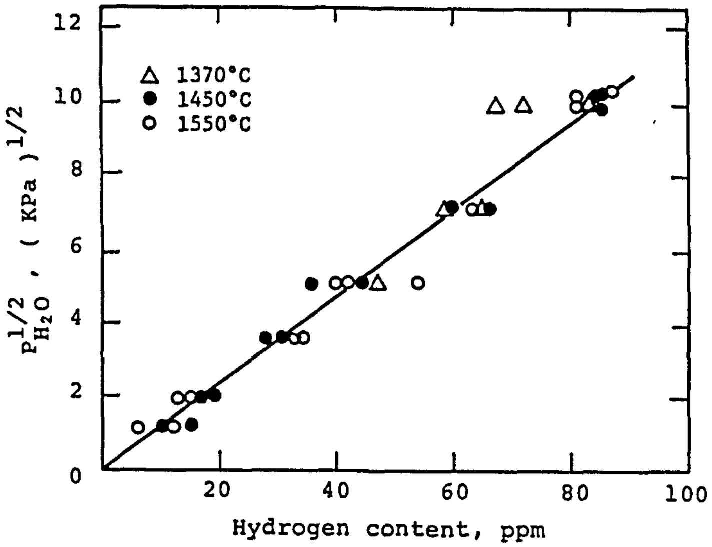
1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 225 - 232.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Water; H_2O; [7732-18-5] (2) Alumina; Al_2O_3; [1344-28-1] (3) Calcium oxide; CaO; [1305-78-8] (4) Silica; SiO_2; [7631-86-9]	Walsh, J. H.; Chipman, J.; King, T. B.; Grant, N. J. **J. Metals** 1956, 8, 1568 - 1576.
VARIABLES: T/K = 1643, 1723, 1823 mass% $Al_2O_3/CaO/SiO_2$ = 20/40/40 H_2O P/kPa: 1.0 - 101.3 (7.7 - 760 mmHg)	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in ppm of H as a function of $P_{H_2O}^{1/2}$ in 20% Al_2O_3 - 40% CaO - 40% SiO_2 (mass) melts at 1370, 1450, 1450,^{2}and 1550°C, and in graphical form only.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
A slag in a Pt crucible was equilibrated, with the stream at nearly one atm. of $N_2 + H_2O$ and was quenched by lowering the crucible into either Hg or H_2O. The solubility of H_2O was analyzed as H content by applying the vacuum fusion technique to the sample wrapped with Al foil, heating at about 1600°C.	The slags were prepared by mixing the chemically pure constituents.
	ESTIMATED ERROR: $\delta(ppm)/(ppm) = \pm\ 0.048$ (authors)
	REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Phosphorous oxide; P_2O_5; [1314-56-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

VARIABLES:

T/K = 1773
H_2O P/kPa = 38.5 (289 mmHg)
mol% P_2O_5 = 0-1.4 (0-3.5 mass%)
mol ratio n_2/n_4 = 0.63

PREPARED BY:

M. Shinmei

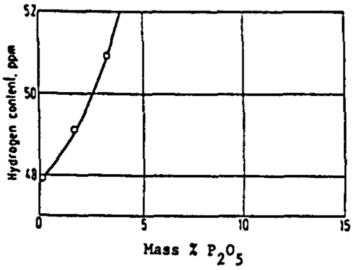
EXPERIMENTAL VALUES:

The authors reported the solubility of water as hydrogen content in CaO - P_2O_5 - SiO_2 melts of constant mass ratio of CaO/SiO_2 (= 0.59) at 1500°C as a function of P_2O_5 concentration at P_{H_2O} = 38.5 kPa (289mmHg) and in graphical form only.

The numerical data were provided by the authors.

mass%			mol%			mass ratio	ppm(mass/mass)	
CaO	P_2O_5	SiO_2	CaO	P_2O_5	SiO_2	CaO/SiO_2	H	H_2O^*
37.1	0	62.9	38.7	0	61.3	0.59	48.5	433
36.4	2.0	61.6	38.4	0.8	60.7	0.59	49	439
35.8	3.5	60.7	38.2	1.4	60.4	0.59	51	456

* Calculated by the compiler.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced by Al at 1500 - 1600°C, and was measured volumetrically using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS;

CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%) at 900°C
P_2O_5: Reagent grade chemical (over 99.8%)
SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

Analysis of H_2 :
δ(ppm)/(ppm) = ± 0.08 (authors)

REFERENCES:

1. Fuwa, T.; Ban-ya, S.; Fukushima, T. **Report of the 19th Committee of the Japan Society for Promotion of Science No. 7834,** May 1965.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Phosphorous oxide; P_2O_5; [1314-56-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, **9**, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol% P_2O_5 = 0-5.5 (0-11 mass%)
mol ratio n_2/n_4 = 1.3

PREPARED BY:

M. Shinmei

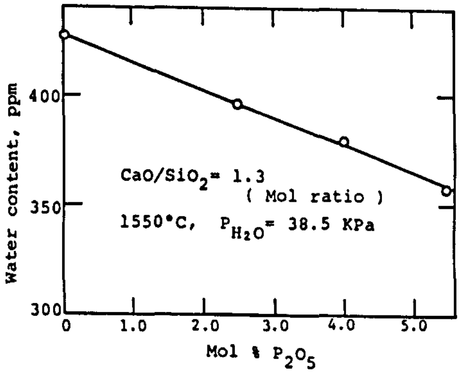
EXPERIMENTAL VALUES:

The authors reported the solubility of water in CaO - P_2O_5 - SiO_2 melts of constant mole ratio of CaO/SiO_2 (= 1.3) at 1550°C as a function of P_2O_5 concentration at P_{H_2O} = 38.5 kPa (289 mmHg), and in graphical form only

The numerical data were provided by the authors.

mol%			mole ratio	ppm*
CaO	P_2O_5	SiO_2	CaO/SiO_2	H_2O
56.5	0	43.5	1.3	427
55.1	2.5	42.4	1.3	397
54.3	4.0	41.7	1.3	379
53.4	5.5	41.1	1.3	357
53.4	5.5	41.1	1.3	357

* mass/mass



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced to H_2 by Al at 1500 - 1600°C, and was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%) at 900°C
P_2O_5: Reagent grade chemical (over 99.8%)
SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

Analysis of H_2:
δ(ppm)/(ppm) = ± 0.08 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, **6**, 225 - 232.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silica; SiO_2; [7631-86-9]
(4) Titanium oxide; TiO_2; [13463-67-7]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/ kPa= 38.5 (289 mmHg)
mass% TiO_2 = 5.0 - 47.5
mol ratio n_2/n_3 = 0.59 - 1.31

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - SiO_2 - TiO_2 melts at 1550°C under the vapor pressure of H_2O at 289 mmHg in graphical form only. The original data were provided by the authors.

mass%			mole ratio	ppm(mass/mass)
CaO	SiO_2	TiO_2	CaO/SiO_2	H_2O
22.0	36.2	39.1	0.65	330
23.9	35.3	39.0	0.73	340
25.4	43.6	29.9	0.85	300
27.2	22.8	47.5	1.28	270
27.4	34.5	37.5	0.85	300
27.4	41.8	29.7	0.70	350
29.6	31.0	38.0	1.02	320
30.1	49.9	19.1	0.65	360
30.9	39.0	29.1	0.85	320
31.9	47.4	20.2	0.72	360
32.3	27.2	38.7	1.27	320
33.1	56.6	10.0	0.59	370
34.1	55.1	10.3	0.66	390
34.4	44.1	19.5	0.84	320
34.8	36.0	28.7	1.04	340

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., and was quenched in a canal made of thick Cu plate. H_2O in the sample was reduced to H_2 by Al at 1550 - 1600°C, and H_2 was measured volumetrically by using a micro-Orsat gas analyzer.

SOURCE AND PURITY OF MATERIALS:

CaO & TiO_2: Reagent grade chemicals
SiO_2: Transparent high purity silica was washed and cleaned (over 99.9%).

ESTIMATED ERROR:

Analysis of H_2:
δ(ppm)/(ppm) < ± 0.08 (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silica; SiO_2; [7631-86-9]
(4) Titanium oxide; TiO_2; [13463-67-7]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. <u>1969</u>, **9,** 189 - 195.

VARIABLES:

$T/K = 1823$
H_2O $P/kPa = 38.5$ (289 mmHg)
mass% $TiO_2 = 5.0 - 47.5$
mol ratio $n_2/n_3 = 0.59 - 1.31$

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

mass%			mole ratio	ppm(mass/mass)
CaO	SiO_2	TiO_2	CaO/SiO_2	H_2O
36.3	53.3	9.9	0.73	380
38.5	31.5	30.0	1.31	360
39.5	41.4	18.6	1.02	350
39.8	49.9	9.8	0.85	340
41.1	32.0	21.8	1.38	400
42.8	46.1	10.6	1.00	380
44.0	36.0	20.0	1.31	370
44.9	38.5	14.6	1.25	390
50.5	41.0	9.2	1.32	410
52.2	42.8	5.0	1.31	370

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Silica; SiO_2; [7631-86-9]
(4) Titanium oxide; TiO_2; [13463-67-7]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mass% TiO_2 = 5.0 - 47.5
mol ratio n_2/n_3 = 0.59 - 1.31

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

mass(%)			mole ratio	ppm(mass/mass)
CaO	SiO_2	TiO_2	CaO/SiO_2	H_2O
50.5	41.0	9.2	1.32	410
52.2	42.8	5.0	1.31	370

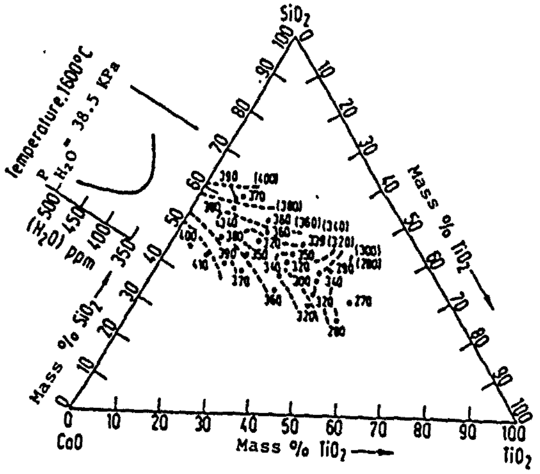


Fig. 1, Solubility of water in CaO - SiO_2 - TiO_2 melts (ppm) at P_{H_2O} = 38.5 kPa and 1550°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Titanium oxide; TiO_2; [13463-67-7]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Ban-ya, S.; Iguchi, Y.; Yamamoto, S.

Tetsu to Hagane 1986, 72, 2210 - 2217.

VARIABLES:

$T/K = 1723$
H_2O P/kPa = various
$n_2/n_3/n_4$ = various

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the iso-water vapor capacities defined by:

$$\log K' = \log(\text{mass \% } H_2O/P^{1/2}_{H_2O})$$

as shown in the figure, where P_{H_2O} is expressed in mm Hg.

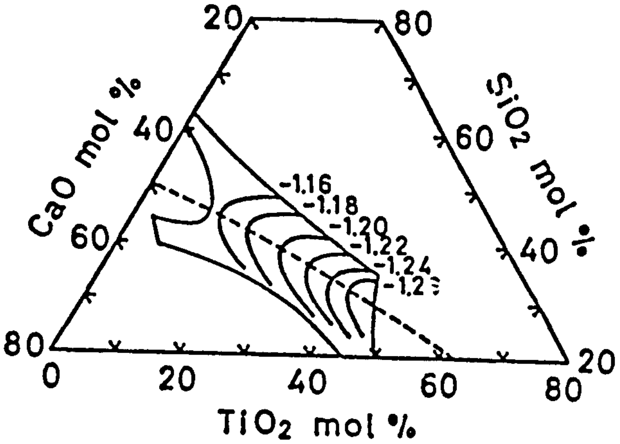


Fig. 1 Iso-water vapor capacity lines in CaO - SiO_2 - TiO_2 melts at 1450°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Synthesized slag was equilibrated with water vapor by blowing nearly one atm. of Ar + H_2O gas mixture over the melt.

Water contents were determined by the method developed by the authors(1).

SOURCE AND PURITY OF MATERIALS:

CaO: made by fining reagent grade $CaCO_3$.
TiO_2: reagent grade TiO_2 powder.
SiO_2: crushed quartz.

ESTIMATED ERROR:

Not described, but is estimated to be of the same order as in ref. 1.

REFERENCES:

1. Ban-ya, S.; Iguchi, Y.; Nagata, S. **Tetsu to Hagane** 1985, 71, 55 - 62.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Manganese oxide; MnO; [1344-43-0]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Abe, Y.

Tetsu to Hagane 1961, **47**, 693 - 698.

VARIABLES:

T/K = 1673
H_2O P/kPa = 2.7 (20 mmHg)
mass% $CaO/MgO/SiO_2$ = 35/30/35

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The author reported the solubility of H_2O in 35% CaO - 30% MnO - 35% SiO_2 melt at 1400°C and at P_{H_2O} = 20 mmHg as (H) = 27.5 (ppm, mass/mass). However, two points should be raised regarding this study : (i) Whether only one hour passing of a $N_2 + H_2O$ stream over the sample was enough to assure the equilibrium state. ii) Using of an Al_2O_3 boat as the sample container might change the above composition by dissolution of Al_2O_3.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in an Al_2O_3 boat was heated for one hour at 1400°C under a stream of $N_2 + H_2O$ at near one atm.

SOURCE AND PURITY OF MATERIALS:

Not given.

ESTIMATED ERROR:

Not given.

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Imai, M.; Ooi, H.; Emi, T.

Tetsu to Hagane 1962, **48**, 111 - 117.

VARIABLES:

mol% FeO = 22.8 - 34.0
mol ratio n_2/n_4 = 0.4 - 3.14
T/K = 1623 - 1823
continued

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - FeO - SiO_2 melts at 1623, 1723 and 1823 K and at P_{H_2O} = 2.8 and 10.1 kPa. Fig. 1 shows the relation between H content and square root of H_2O pressures. Effect of temperature and of basicity on the H content of the melts are shown in Table 1 and in Fig. 2, respectively.

	Composition (mol%)		
	CaO	FeO	SiO_2
A	21.6	26.4	52.0
B	29.1	24.5	46.4
E	52.0	22.8	25.1
G	18.8	34.0	47.2
H	26.6	32.8	40.6
K	46.7	29.8	23.5

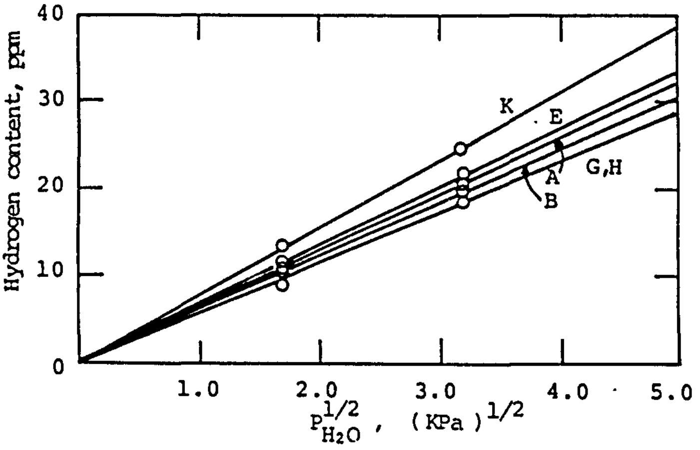


Fig. 1 Solubility of water in CaO - FeO - SiO_2 melts as a function of square root of water vapor pressure at 1550°C.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of Ar + H_2O nearly one atm., and were quenched in either Hg or H_2O. H_2O in the samples was determined by the method of analysis described in ref. 1

SOURCE AND PURITY OF MATERIALS:

All materials used were reagent grade chemicals.

ESTIMATED ERROR:

Not described explicitly.

REFERENCES:

1. Imai, M.; Nakayama, T.; Ooi, H.; Emi, T.

   Tetsu to Hagane 1959, **45**, 1080 - 1082.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Imai, M.; Ooi, H.; Emi, T.

Tetsu to Hagane 1962, **48**, 111 - 117.

VARIABLES:

H_2O P/kPa = 2.8 (21.1 mmHg),
10.1 (76 mmHg)

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued

Table 1
Effect of Temperature on Hydrogen Content of CaO - FeO - SiO_2 Melts

Composition of melts/mol%			Hydrogen content/ppm		
CaO	FeO	SiO_2	1350°C	1450°C	1550°C
29.1	24.5	46.4	11.7	16.0	19.8
38.7	24.3	37.0	15.7	17.0	19.3
26.6	32.8	40.6	16.1	18.5	19.1
33.4	33.6	33.0	15.1	16.4	19.7

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O [7732-18-5]
(2) Calcium oxide; CaO [1305-78-8]
(3) Iron oxide; FeO [1345-25-1]
(4) Silica; SiO_2 [7631-86-9]

ORIGINAL MEASUREMENTS:

Imai, M.; Ooi, H.; Emi, T.
Tetsu to Hagane, 1962, 48, 111 - 117

VARIABLES:

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

continued.

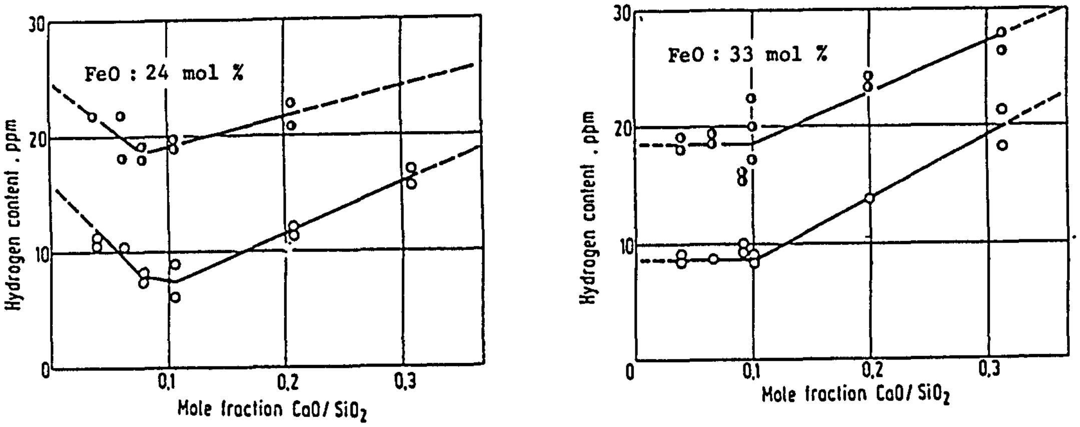


Fig. 1 Effect of basicity on the hydrogen content of CaO - FeO - SiO_2 melts at 1550°C. ◑ P_{H_2O} = 76 mmHg, ○ P_{H_2O} = 21.1 mmHg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Imai, M.; Ooi, H.; Emi, T.

Tetsu to Hagane 1964, 50, 878 - 887.

VARIABLES:
mol% FeO = 3.1 - 39.2
mol% CaO = 18.8 - 57.6
H_2O P/kPa = 2.8 - 90.9
T/K = 1823 & 1873

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors studied the solubility of H_2O in various CaO - FeO - SiO_2 melts coexisting with liquid iron at 1550 and 1600°C. Considering the dissolution reaction of H_2O takes place:

$$H_2O(g) + O(melt) = 2OH(melt) \qquad (1)$$

$$K_1 = C_{OH}{}^2/P_{H_2O} \times a_O$$

they obtained:

$$\log K_1 = -2160/T + 8.144 \qquad (2)$$

where C_{OH} is the concentration of OH in the melt expressed in ppm (mass/mass), P_{H_2O} is the pressure of H_2O expressed in atm, and a_O is the activity of oxygen which was assumed to equal the activity of FeO.

The compiler obtained the following as solubility of H_2O:

$$\log C_{H_2O}(\text{ppm, mass/mass}) = -1080/T + 2.789 + (1/2)\log P_{H_2O}(\text{KPa}) + (1/2)\log a_O$$

$$\log C_{H}(\text{ppm, mass/mass}) = -1080/T + 1.838 + (1/2)\log P_{H_2O}(\text{KPa}) + (1/2)\log a_O$$

The original data are shown in Tables 2 and 3. (authors).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in SiO_2 crucibles were equilibrated with the stream of Ar + H_2O at near one atm., and were quenched.

The analysis of H in the sample was made by the method described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

All materials used were reagent grade chemicals.

ESTIMATED ERROR:

Not given.

REFERENCES:

1. Imai, M.; Nakayama, T.; Ooi, H.; Emi, T.

   Tetsu to Hagane 1959, 45, 1080 - 1082.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Wahlster, M.; Reichel, H.-H.

Arch. Eisenhuttenwes. 1969, 40, 19 - 25.

VARIABLES: mol% n_3 = 20 & 35
mol ratio n_2/n_4 = 20/20 & 30/35
H_2O P/kPa = 101.3 (760 mmHg)
T/K = 1683 - 1873

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in CaO - FeO - SiO_2 melts as a function of temperature at P_{H_2O} = 101.3 kPa.

For 20 mol% CaO - 30 mol% FeO - 35 mol% SiO_2 melt:

$$\log H(\mathrm{ppm}) = -625/T + 2.04$$

$$\log H_2O^*(\mathrm{ppm}) = -625/T - 1.01$$

and for 20 mol% CaO - 60 mol% FeO - 20 mol% SiO_2 melt:

$$\log H(\mathrm{ppm}) = -1940/T + 2.89$$

$$\log H_2O^*(\mathrm{ppm}) = -1940/T - 0.159$$

* Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of Ar + H_2O at nearly one atm., and were quenched.

The solubility of H_2O was determined by the method described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Analysis of hydrogen
$\delta(\mathrm{ppm})/(\mathrm{ppm}) = \pm 0.05$

REFERENCES:

1. Obst, K.-H.; Malissa, H.

Arch. Eisenhuttenwes. 1959, 30, 601 - 603.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Wahlster, M.; Reichel, H. H.

Arch. Eisenhuttenwes. 1969, **40,**
19 - 25.

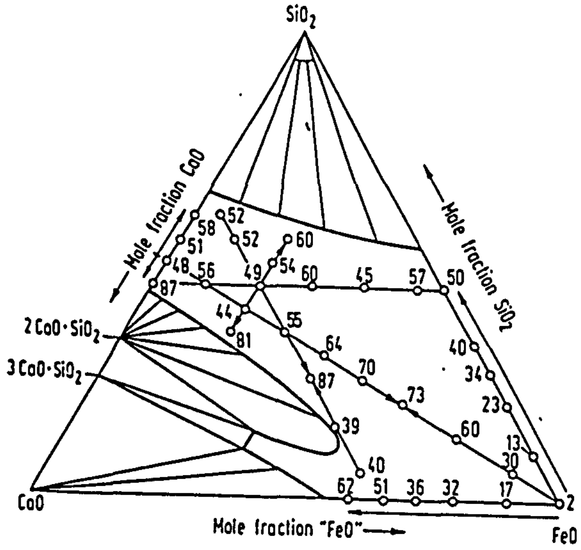
VARIABLES: T/K = 1873 (1600°C)
H_2O P/kPa = 101.3 (760 mmHg)
mol% FeO = 0 - 100
mol% SiO_2 = 0 - 50

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - FeO - Sio_2 melts at 1873 K and at $P_{H\ O}$ = 101.3 kPa (actual measurements were carried out at $P_{H\ O}$ = 31.2 kPa). ^{2}The numerical values in the figure are ppm (mass^2/mass) of hydrogen.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of Ar + H_2O at near one atm. and were quenched.

The solubility of H_2O was determined by the method described in ref. 1.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

analysis of hydrogen
δ(ppm)/(ppm) = ± 0.05 (authors)

REFERENCES:

1. Obst, K.-H.; Malissa, H.

Arch. Eisenhuttenwes. 1959, **30,**
601 - 603.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO;
[1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mass% FeO = 3.9 - 19.8
mol ratio n_2/n_4 = 0.62 - 1.28

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - FeO - SiO_2 melts at 1550°C under the vapor pressure of H_2O at 289 mmHg in graphical form, and the original data were provided by the authors.

mass %			mole ratio	ppm(mass/mass)
CaO	FeO	SiO_2	CaO/SiO_2	H_2O
30.1	19.7	49.1	0.66	430
30.7	14.5	53.2	0.62	450
32.8	10.4	56.2	0.63	410
34.7	5.3	58.3	0.64	500
35.7	14.8	48.1	0.80	470
38.1	9.6	51.3	0.80	460
38.2	19.8	40.9	1.00	400
39.6	5.5	54.2	0.78	400
40.7	14.7	43.6	1.00	570
41.1	19.0	39.0	1.13	440
42.7	9.2	46.0	0.98	610
42.9	19.3	36.6	1.26	510
43.5	14.0	41.6	1.12	540
44.3	4.8	48.7	0.97	670
46.1	9.2	43.9	1.13	600
46.6	13.1	39.2	1.27	700
48.6	4.6	46.1	1.13	520
49.2	8.4	41.1	1.28	830
51.4	3.9	43.9	1.25	640

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream of nearly one atm., where the oxygen potential was maintained to keep 1.5 x 10^6 atm. at 1550°C, and was quenched in a canal made of thick Cu plate.

H_2O in the sample was measured as H_2 volumetrically by a micro-Orsat gas analyzer after reducing with Al at 1550 - 1600°C.

SOURCE AND PURITY OF MATERIALS:

All oxides used were reagent grade chemicals except silica, which was transparent high purity silica ground to the size of 100 mesh and washed and cleaned (over 99.9% SiO_2), FeO was prepared by heating ferrous oxalate at 500°C for 5 hrs. in the Ar stream.

ESTIMATED ERROR:

analysis of H_2:
δ(ppm)/(ppm) = less than ± 0.04
(authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1969, 9, 189 - 195.

VARIABLES:

$T/K = 1823$
H_2O $P/kPa = 38.5$ (289 mmHg)
mass% FeO = 3.9 - 19.8
mol ratio $n_2/n_4 = 0.62 - 1.28$

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

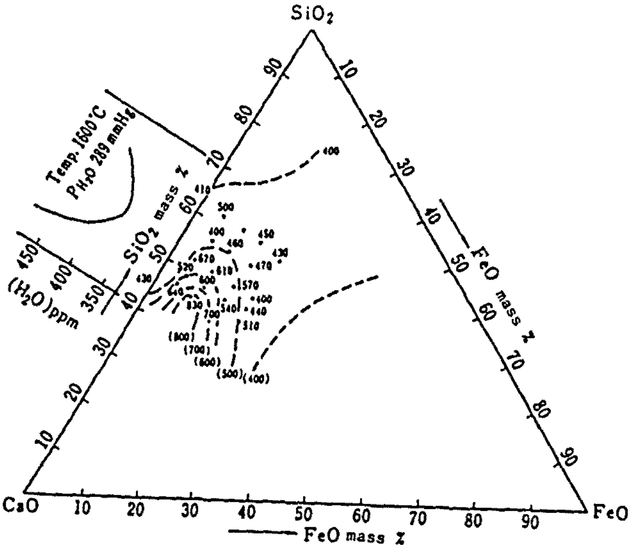


Fig. 1 Iso-solubility lines of water (ppm) in CaO - FeO - SiO_2 melts at 1550°C and $P_{H_2O} = 38.5$ kPa.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Germanium oxide; GeO_2; [1310-53-8]
(4) Silica; SiO_2; [7631-53-8]

ORIGINAL MEASUREMENTS:

Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1966, 6, 225 - 232.

VARIABLES:

T/K = 1773
H_2O P/kPa = 38.5 (289 mmHg)
mol% GeO_2 = 3 - 9
mol ratio n_2/n_4 = 0.63

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - GeO_2 - SiO_2 melts at 1500°C and at 289 mmHg of H_2O in graphical form (the numerical data are given in ref. 1).

Mass%			Mol %			Mole Ratio	ppm(mass/mass)	
CaO	GeO_2	SiO_2	CaO	GeO_2	SiO_2	CaO/SiO_2	H	H_2O^*
35.3	5	59.7	37.7	2.9	59.4	0.63	48	428
33.4	10	56.6	36.5	5.8	57.7	0.63	50	450
31.5	15	53.5	35.2	9.0	55.8	0.63	51	460
31.5	15	53.5	35.2	9.0	55.8	0.63	50	450

* Calculated by the compiler

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a Pt crucible was equilibrated with the H_2O + Ar stream at nearly one atm., and was quenched in a water cooled Cu mold.

H_2O in a quenched sample was reduced to H_2 by Al at 1500 - 1600°C, and was measured volumetrically by using a micro-Orsat gas analyzer. (ref. 1)

SOURCE AND PURITY OF MATERIALS:

CaO: Made by thermal decomposition of reagent grade carbonate (over 99.5%) at 900°C.
GeO_2: Reagent for semi-conductor materials (over 99.999999%)
SiO_2: Ground quartz (over 99.9%)

ESTIMATED ERROR:

$\delta(ppm)/(ppm) = \pm 0.08$ (authors)

REFERENCES:

1. Fuwa, T.; Ban-ya, S.; Fukushima, T. **Report of the 19th Committee of the Japan Society for Promotion of Science, No. 7834,** May 1965.

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Potassium oxide; K_2O; [12136-45-7]
(3) Sodium oxide; Na_2O; [1313-59-3]
(4) Lead oxide; PbO; [1317-36-8]
(5) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Russell, L. E.

J. Soc. Glass Tech. 1957, **41**, 304T - 317T.

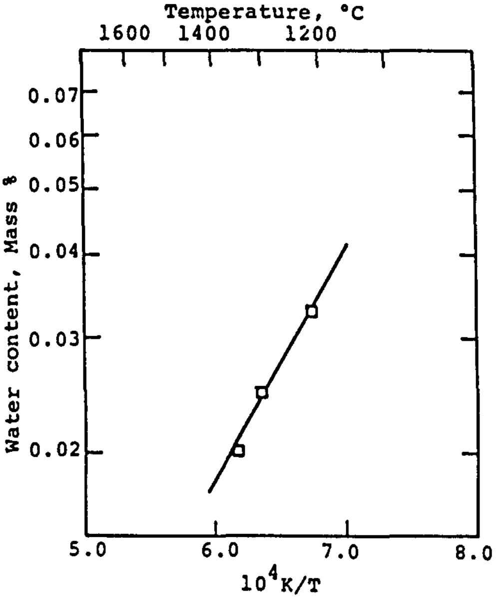
VARIABLES: T/K: 1490 - 1520
H_2O P/ kPa= 101.3
mol ratio $K_2O/Na_2O/PbO/SiO_2$ = 8/5/30/57

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The author reported the solubility of H_2O in commercial lead glass melt at P_{H_2O} = 101.3 kPa. in the temperature range 1490 - 1520 K.



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The stream of H_2O at near one atm. was bubbled up through the melt in a mullite tube. The determination of the solubility of H_2O was made by the gas purging method with dry O_2.

SOURCE AND PURITY OF MATERIALS:

Commercial lead glass.

ESTIMATED ERROR:

δ(ppm)/(ppm): within ± 0.10 (author)

REFERENCES:

COMPONENTS:

(1) Water; H_2O; [7732-18-5]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Iron oxide; FeO; [1345-25-1]
(4) Magnesium oxide; MgO; [1309-48-4]
(5) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Iguchi, Y.; Ban-ya, S.; Fuwa, T.

Trans. Iron Steel Inst. Jpn. 1970, 10, 29 - 35.

VARIABLES:

T/K = 1823
H_2O P/kPa = 38.5 (289 mmHg)
mol ratio n_2/n_5 = 1.1
mol% FeO=0-11.8, mol% MgO=17.0-21.3

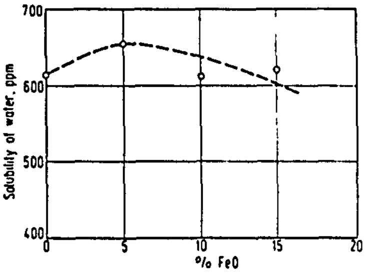
PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of H_2O in various CaO - FeO -MgO - SiO_2 melts at 1550°C and at P_{H_2O} = 38.5 kPa in graphical form only. The original data were provided by the authors.

mol%				mole ratio	ppm(mass/mass)
CaO	FeO	MgO	SiO_2	CaO/SiO_2	H_2O
39.8	0	21.3	38.9	1.02	616
40.5	3.8	18.5	37.2	1.09	650
38.9	7.6	17.8	35.7	1.09	577
37.1	11.8	17.0	34.1	1.09	635



AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in Pt crucibles were equilibrated with the stream of Ar + H_2O at near one atm., and were quenched. Details of experimental procedure and analysis of H_2O in the sample are described in refs. 1 and 2.

SOURCE AND PURITY OF MATERIALS:

All materials were reagent grade chemicals.

ESTIMATED ERROR:

Analysis of H_2O:
$\delta(ppm)/(ppm) = \pm 0.06$ (authors)

REFERENCES:

1. Fukushima, T.; Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Trans. Iron Steel Inst. Jpn.** 1966, 6, 225 - 232.
2. Iguchi, Y.; Ban-ya, S.; Fuwa, T. **Ibid.** 1969, 9, 189 - 195.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Calcium oxide; CaO; [1305-78-8]
(3) Sodium oxide; Na_2O; [1313-59-3]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Mulfinger, H.-O.

J. Amer. Ceram. Soc. 1966, 49, 462 - 467.

VARIABLES:

$T/K = 1673$
N_2 $P/kPa = 101.3$
$n_2/n_3/n_4 = 10/16/74$

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The author reported the solubility of N_2 (physically melted) in CaO - Na_2O - SiO_2 melts at 1400°C.

Melt Composition (mol%)			Solubility of N_2 (ml(STP)/ml glass)
CaO	Na_2O	SiO_2	
10	16	74	4.2×10^{-4}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The melted glass was saturated by bubbling N_2 at nearly one atm. at 1400°C for 16 hr. The concentration of N_2 was determined by hot extraction and gas chromatographic analysis described in the reference.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

The deviation in 4 measurements was about ± 2%. The author estimated the absolute error was about 15%.

REFERENCES:

Mulfinger, H.-O.; Scholzie, H.

Glastech. Ber. 1962, 35, 495 - 500.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Kamyshov, V. M.; Esin, O. A.; Chuchmrev, S. K.
Izv. Vyssikh. Uchebn. Zavedeii, Chern, Met. 1964, 7(7), 24 - 28;
Chem Abstr; 1964, 61, 13021h (*)

VARIABLES:

T/K = 1773
N_2 P/kPa = 93.2; CO P/kPa = 8.1
$m_2/m_3/m_4$ = 10-50/ 23-50/ 30-57

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of N_2 in various compositions of the Al_2O_3 - CaO - SiO_2 melt contained in a carbon crucible at 1773 K under the stream of N_2 + CO (92 vol.% N_2 and 8 vol.% CO).

Mass %			
Al_2O_3	CaO	SiO_2	N
10.0	50.0	40.0	0.435
20.0	23.0	57.0	0.237
20.0	30.0	50.0	0.153
20.0	50.0	30.0	0.210
25.0	40.0	35.0	0.442
50.0	50.0	--	1.460

Heat of N_2 dissolution = 263.6 ± 8.4 kJ/g atom N

(*) Data taken from the abstract

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The samples in a graphite crucible were melted at 1773 K and N_2 + CO mixture was blown through a capillary tube immersed in the melt. The equilibrium was established within 2 hrs.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Shimoo, T.; Kimura, H.; Kawai, M.

Nippon Kinzoku Gakkaishi, 1971, 35, 1103 - 1108.

VARIABLES:

T/K = 1673; 1723; 1773; 1823
N P/kPa = 93.2; CO P/kPa = 8.1
$m_2/m_3/m_4$ = 0-50/ 10-50/ 0-72

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of N in the 20Al_2O_3 - 40CaO - 40SiO_2 (mass%) melt with graphite saturation at the temperatures 1673, 1723 and 1773 K under the stream of N_2 + CO mixture. The apparent solubility for the melt was expressed by a least square treatment as:

$$\log C_N(\text{mass\%}) = 23400T^{-1} + 12.7$$

under P_{N_2} = 93.2 kPa; P_{CO} = 8.1 kPa.

The authors also reported the solubility of N in various compositions of the Al_2O_3 - CaO - SiO_2 melts whose compositions are shown in Fig. 1 and in Table 1, with graphite saturation at 1773 K. The form of N dissolved in the melts was supposed to be ions such as CN^-, N^{3-} CN_2^{2-}.

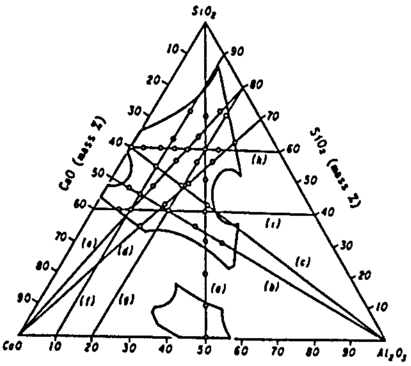


Fig. 1. Slag compositions investigated on solubilities of nitrogen in molten CaO - SiO_2 - Al_2O_3 slag at 1773 K. Bold lines show liquid composition limit at this temperature.

(Continued)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample in a graphite crucible was equilibrated with the N_2 + CO stream of nearly one atm. The sampling for chemical analysis was made by quenching the melt with a stainless steel rod. Nitrogen was analyzed by the combustion method described in the previous report (1).

SOURCE AND PURITY OF MATERIALS:

Al_2O_3: Chemicals, more than 99.8 mass% purity
CaO : Reagent grade $CaCO_3$ was fired
SiO_2 : Pulverized quartz

ESTIMATED ERROR:

δ(mass)/(mass) = ± 0.03 - 0.12
Authors (2)

REFERENCES:

1. Kimura, H.; Izumi, T.; Dan, T.; Shimoo, T.; Kawai, M. **Nippon Kinzoku Gakkaishi** 1970, 34, 884 - 887.
2. Shimoo, T.; Kimura, H.; Kawai, M. **Nippon Kinzoku Gakkaishi** 1971, 35, 417 - 422.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Shimoo, T.; Kimura, H.; Kawai, M.

Nippon Kinzoku Gakkaishi 1971, 35, 1103 - 1108.

VARIABLES:

T/K = 1673, 1723, 1773, 1823
N_2 P/kPa = 93.2, CO P/kPa = 8.1
$m_2/m_3/m_4$ = 0 - 50/ 10 - 50/ 1 - 72

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

Table 1 Solubility of N in Al_2O_3 - CaO - SiO_2 Melts at 1773 K
(P_{N_2} = 93.2 kPa, P_{CO} = 8.1 kPa)

mass %				mass %			
Al_2O_3	CaO	SiO_2	N	Al_2O_3	CaO	SiO_2	N
0	40	60	0.24	16	20	64	0.17
3	37	60	0.18	18	40	42	0.24
6	47	47	0.45	20	10	70	0.07
7	53	40	0.55	20	20	60	0.13
8	32	60	0.16	20	25	55	0.14
10	18	72	0.04	20	32	48	0.15
10	27	63	0.16	20	40	40	0.26
10	36	54	0.49	21	30	49	0.15
10	45	45	0.56	24	16	60	0.05
10	50	40	0.53	24	20	56	0.10
12	28	60	0.15	25	25	50	0.14
12	40	48	0.52	27	10	63	0.07
14	30	56	0.15	30	28	42	0.25
15	15	70	0.05	30	30	40	0.25
15	25	60	0.14	30	35	35	0.29
15	50	35	0.52	35	35	30	0.12

cont'd..

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Shimoo, T.; Kimura, H.; Kawai, M.

Nippon Kinzoku Gakkaishi 1971, 35, 1103 - 1108.

VARIABLES:

PREPARED BY:

M. Shinmei.

EXPERIMENTAL VALUES:

continued

mass %			
Al_2O_3	CaO	SiO_2	N
40	30	30	0.21
40	40	20	0.07
45	45	10	0.45
50	50	0	0.50

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Davies, M. W.; Meherali, S. G.

Metal. Trans. 1971, 2, 2729 - 2733.

VARIABLES:

$T/K = 1773; 1823; 1873$
N_2 $P/kPa = 20.3 - 70.9$

continued

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors studied the equilibrium solubility of N in aluminosilicate melts with compositions close to those of blast furnace slag with respect to major constituents.

Table Solubility of Nitrogen in Al_2O_3 - CaO - SiO_2 Melts with Carbon Saturation Under Various Gas Mixtures of N_2 + CO + Ar

T/K	Melt Comp. (mol%)	Atmosphere % N_2	CO	Ar	N Solubility atom%^{a}	mass%	No. of Experiments
1773	Al_2O_3= 12.1 CaO = 47.1 SiO_2 = 37.9	20	60	20	0.511±0.03	0.116±0.007	5
		20	40	40	0.819±0.03	0.195±0.01	8
		50	40	10	1.329±0.10	0.303±0.02	7
1823		50	40	10	2.96 ±0.09	0.673±0.02	8
		20	40	40	1.90 ±0.13	0.428±0.03	13
		40	60	0	1.67 ±0.07	0.379±0.016	12
		20	60	20	1.19 ±0.06	0.264±0.012	5

continued

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

N_2 + CO + Ar gas mixtures at nearly one atm. were passed over the samples contained in a carbon crucible at 5 ml/sec.
After equilibrium was attained the samples were quenched by lowering into a bath of dried oil. The quenched samples were broken into pieces and analyzed for N by a similar method as in ref.1 (the N extraction method of melting with oxidizing flux in a vacuum).

SOURCE AND PURITY OF MATERIALS:

High-purity SiO_2
"Analar" grade Al_2O_3; $CaCO_3$
CaO: made by thermal decomposition of $CaCO_3$ for 16 hrs. at 1373 K.
Graphite Crucible: high quality electrode graphite
Ar: 99.995%
N_2: 99.99%
CO: 97%, remainder N_2

ESTIMATED ERROR:

$\delta(mass)/(mass)$ = within ± 0.015 (Authors)

REFERENCES:

1. Chuchmarev, S. K.; Kamyshov, V. M.

   Zavodsk. Lab. 1964, 30, 1034.

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Davies, M. W.; Meherali, S. G.

Metal. Trans. 1971, 2, 2729 - 2733.

VARIABLES:

CO P/kPa = 20.3 - 60.8
$n_2/n_3/n_4$ = 12.1 - 12.4/47.05 - 55.1/30.95 - 37.9

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

T/K	Melt Comp. (mol%)	Atmosphere %			N Solubility		No. of Experiments
		N_2	CO	Ar	atom%[a]	mass%	
1823	Al_2O_3= 12.0 CaO = 55.1 SiO_2 = 31.0	70	20	10	4.21 ±0.31	0.975±0.076	9
		55	25	20	3.10 ±0.19	0.703±0.03	8
		50	40	10	1.68 ±0.04	0.378±0.009	6
		20	40	40	1.10 ±0.09	0.247±0.021	8
		40	60	0	0.93 ±0.08	0.211±0.019	10
		20	60	20	0.784±0.10	0.177±0.02	9
1873		20	60	20	1.19 ±0.07	0.264±0.02	7
		50	40	10	2.98 ±0.16	0.674±0.02	
		55	25	20	6.02 ±0.3	1.424±0.07	6

[a] Definition is given by (No. of g-atom N)/(No. of g-atom N + No. of g-mol of oxide)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Nitrogen; N_2; [7727-37-9] (2) Alumina; Al_2O_3; [1344-28-1] (3) Calcium oxide; CaO; [1305-78-8] (4) Silica; SiO_2; [7631-86-9]	Dancy, E. A.; Janssen, D. **Can. Metallurgical Quart.** 1976, 15, 103 - 110.
VARIABLES: $T/K = 1723 - 1923$ N_2 $P/kPa = 101.3$ $m_2/m_3/m_4 = 0 - 50/30 - 50/0 - 45$	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of N in Al_2O_3 - CaO - SiO_2 slags under a variety of highly reducing conditions. In Table 1 are the results with graphite and those with various reducing agents are in Table 2. N content at one atm. N_2 with graphite is given in Fig. 1 as a function of temperature (graphical form only).

Table 1. N Content of Various Al_2O_3 - CaO - SiO_2 Slags Under One Atm. N_2 at 1823 K

Composition (mass %)			N Content (mass %)*								
CaO	SiO_2	Al_2O_3	Hot Extraction			HF+HCl+H_2O_2			HF+H_2SO_4		
			-50	-30+50	+30	-50	-30+50	+30	-50	-30+50	+30
55	45			1.06		.61	.70	.71			
51	44	5		.98			.63	.63		.73	
45	50	5		.68			.48	.53		.59	
				.63							

* As determined by different analytical methods on different size particles (expressed in "mesh").

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

N solubility in Al_2O_3 - CaO - SiO_2 slags in graphite was determined using an apparatus and technique similar to those of Davies et al. (1). The samples were held in the appropriate atmosphere for the required time and then quenched by lowering into oil. N content of the slags was determined both by hot extraction similar to that used by Chuchmarev et al. (2) and by the Kjeldahl method with two different solvents of H_2SO_4 and HF and HCl + HF + H_2O.

SOURCE AND PURITY OF MATERIALS:

Not described.

ESTIMATED ERROR:

Not evaluated.

REFERENCES:

1. Davies, M. W.; Meherall, S. G. **Met. Trans.** 1971, 2, 2729 - 2733.
2. Chuchmarev, S. K.; Kamyshov, V. M. **Zavodsk. Lab.** 1964, 30, 1034.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Nitrogen; N_2; [7727-37-9] (2) Alumina; Al_2O_3; [1344-28-1] (3) Calcium oxide; CaO; [1305-78-8] (4) Silica; SiO_2; [7631-86-9]	Dancy, E. A.; Janssen, D. **Can. Metallurgical Quart.** 1976, 15, 103 - 110.
VARIABLES:	PREPARED BY: M. Shinmei

EXPERIMENTAL VALUES: continued

Composition (mass %)			N Content (mass %)*								
CaO	SiO_2	Al_2O_3	Hot Extraction			$HF+HCl+H_2O_2$			$HF+H_2SO_4$		
			-50	-30+50	+30	-50	-30+50	+30	-50	-30+50	+30
50	40	10		.90		.77	.84	.84			
42.75	42.25	10		.28		.24	.28	.27			
50	30	20		2.56		2.19	2.19 2.01	2.08			
47.5	32.5	20		1.82			1.75	1.78		1.91	
40	40	20		.41		.44 .34	.36		.29		
40	30	30		1.01							
35	35	30		.26			.28	.33	.30		
35	35	30		.41			.31	.36 .33			
50	10	40		2.71		3.03	2.43	2.04			
50	10	40		2.21		2.29	2.18				
30	30	40		.40			.41	.54			
40	10	50	1.92	2.00	2.42		1.91	1.61 1.30		1.73	
49	2	49		1.90				1.78 1.75			
50		50		1.13		1.17		1.21		1.23	

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
	ESTIMATED ERROR:
	REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Dancy, E. A.; Janssen, D.

Can. Metallurgical Quart. 1976, 15, 103 - 110.

VARIABLES:

T/K = 1723 -1823
N_2 P/kPa = 101.3

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

Table 2. Nitrogen Content of Three Slags After Treatment with Nitrogen in the Presence of Various Reducing Agents in the Absence of Graphite

Slag 5 g Charge	Reducing Agent (g)	Cruc Matl	Temp. (°C)	Time (hrs)	Atmos.	N Content (mass %)	
						Hot Ext	Kjekdahl
	Si, 0.06	Fe	1450	4	N_2	0.33	0.30
	Si, 0.05	Fe	1500	2	N_2	0.48	0.36
	Si/Fe, 0.25/2.5	MgO	1500	2	N_2	0.26	0.25
Mass %	Si, 0.25	MgO	1450	2	N_2	1.75	1.41
	Si, 0.25	MgO	1500	2	N_2	1.64	1.40
Al_2O_3 = 40	Si, 0.50	MgO	1500	2	N_2	2.90	2.63
	Al, 0.05	Fe	1450	3	N_2	0.04	0.01
CaO = 50	Al/Fe, 0.25/2.5	MgO	1500	2	N_2	0.10	0.07
	Al/Fe, 0.25/2.5	MgO	1550	2	N_2	0.17	0.14
SiO_2 = 10	Al, 0.25	MgO	1450	2	N_2	1.22	0.71
	Al, 0.50	MgO	1450	2	N_2	1.15	0.81
	Si_3N_4, 0.50	MgO	1450	2	N_2	3.92	3.30
	CaC_2, 0.25	MgO	1500	2	N_2	--	0.01
	CaC_2, 0.25	MgO	1550	2	N_2	0.06	0.05
	CaC_2, 0.50	MgO	1500	2	N_2	0.47	0.41

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Dancy, E. A.; Janssen, D.

Can. Metallurgical Quart. 1976, **15**, 103 - 110.

VARIABLES:

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES: continued

	CaC_2, 0.50	MgO	1500	5	N_2	0.23	0.25
	CaC_2, 0.50	MgO	1550	2	N_2	0.17	0.10
	Si, 0.05	Fe	1450	2	N_2	0.37	0.39
	Si/Fe, 0.125/2.5	Al_2O_3	1500	2	N_2	0.06	0.04
	Si/Fe, 0.125/2.5	Al_2O_3	1550	2	N_2	0.16	0.04
	Si, 0.05	Al_2O_3	1450	2	N_2	0.09	0.06
	Si, 0.25	Al_2O_3	1450	2	N_2	0.20	0.14
	Si, 0.25	Al_2O_3	1450	5	N_2	0.21	0.16
Al_2O_3 = 40	Si, 0.25	Al_2O_3	1500	2	N_2	0.18	0.09
	Al, 0.25	Al_2O_3	1450	2	N_2	0.04	0.04
CaO = 30	Si_3N_4, 0.25	Al_2O_3	1450	2	N_2	1.45	1.20
	Si_3N_4, 0.25	Al_2O_3	1500	2	N_2	1.54	1.41
SiO_2 = 30	Si_3N_4, 0.50	Al_2O_3	1450	2	N_2	2.75	2.07
	Si_3N_4, 0.50	Al_2O_3	1450	2	Ar	2.52	2.50
	Si_3N_4, 1.00	Al_2O_3	1450	2	N_2	3.57	2.53
	Si_3N_4, 1.00	Al_2O_3	1450	5	N_2	3.21	2.32
	Si_3N_4, 1.00	Al_2O_3	1450	2	$25N_2/75Ar$	3.91	2.88
	CaC_2, 0.25	Al_2O_3	1550	2	N_2	0.13	0.14
	CaC_2, 0.50	Al_2O_3	1550	2	N_2	0.39	0.24
Al_2O_3 = 20	Si, 0.25	MgO	1450	2	N_2	0.13	0.12
	Al, 0.25	Al_2O_3	1450	2	N_2	0.04	0.10
CaO = 40	Si_3N_4, 0.50	MgO	1450	2	N_2	2.19	2.18
	CaC_2, 0.25	MgO	1550	2	N_2	0.02	0.02
SiO_2 = 40	CaC_2, 0.50	MgO	1500	2	N_2	0.54	0.42
	CaC_2, 0.50	MgO	1550	2	N_2	0.67	0.53

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Nitrogen; N_2; [7727-37-9] (2) Alumina; Al_2O_3; [1344-28-1] (3) Calcium oxide; CaO; [1305-79-8] (4) Silica; SiO_2; [7631-86-9]	Dancy, E. A.; Janssen, D. **Can. Metallurgical Quart.** <u>1976</u>, 15, 103 - 110.
VARIABLES:	**PREPARED BY:**
T/K = 1723 - 1823 N_2 P/kPa = 101.3 $m_2/m_3/m_4$ = 20 - 40/30 - 50/10 - 40	M. Shinmei

EXPERIMENTAL VALUES:

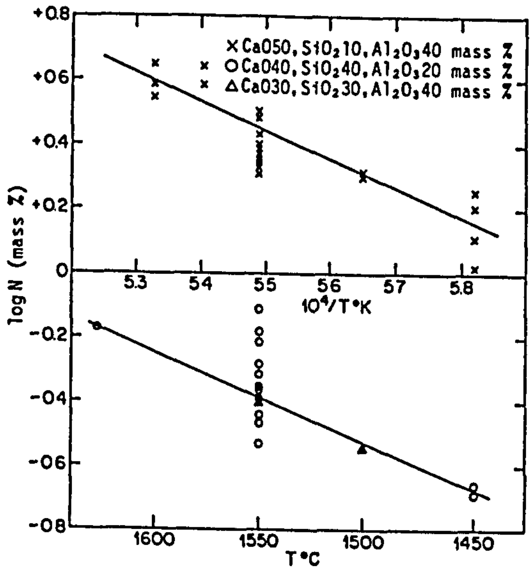


Figure 2. Nitrogen content of three slags as a function of temperature. Graphite crucibles.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Chuchmarev, S. K.; Esin, O. A.; Kamyshev, V. M.

Izv. Vysshikh. Uchebn. Zavedenii, Chern. Met. 1965, **8(2), 5 - 9; Chem. Abstr;** 1965, **62, 14233g (**)**

VARIABLES:

T/K = 1673&1773 N_2 P/kPa=32.4-93.2
CO P/kPa = 11.1 - 68.9
$m_2/m_3/m_4$ = 12.1/47.6/40.3

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the solubility of N in the 12.1 Al_2O_3 - 47.6 CaO - 40.3 SiO_2 (mass %) melt saturated with graphite at 1673 K and 1773 K under the various N_2 + CO gas mixtures, and they interpreted that the form of N in the melt was CN^- by the following reactions:

$$3C + O^{2-} + N_2 = 2CN^- + CO \text{ , at 1673 K}$$

$$3C + O^{2-} + C_2^{2-} + 2N_2 = 4CN^- + CO\text{, at 1773 K}$$

N_2 P/kPa	CO P/kPa	N at 1673 K (mass %)*	N at 1773 K (mass %)*
93.2	8.1	0.139	0.325
82.1	11.1	0.088	0.178
65.8	35.5	0.063	---
32.4	68.9	0.031	0.114

* Original report gave the solubility as "ml/100 g". The compiler converted to "mass %".

** Data taken from the abstract

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The sample was saturated with N and C by bubbling N_2 and CO gases under nearly one atm. at 1673 K and 1773 K.

SOURCE AND PURITY OF MATERIALS:

ESTIMATED ERROR:

REFERENCES:

COMPONENTS:

(1) Nitrogen; N_2; [7727-37-9]
(2) Alumina; Al_2O_3; [1344-28-1]
(3) Calcium oxide; CaO; [1305-78-8]
(4) Magnesium oxide; MgO; [1309-48-4]
(5) Silica; SiO_2; [7631-86-9]

ORIGINAL MEASUREMENTS:

Davies, M. W.; Meherali, S. G.

Metal. Trans. 1971, 2, 2729 - 2733.

VARIABLES: T/K = 1823

N_2 P/kPa = 50.7; CO P/kPa = 40.5
$n_2/n_3/n_4/n_5$ = 12.1-12.5/32.6-47.0
7.3-14.8/24.7-37.9

PREPARED BY:

M. Shinmei

EXPERIMENTAL VALUES:

The authors reported the equilibrium solubility of N in the slag melts with compositions close to those of blast furnace slag with respect to major constituents at 1823 K.

Table Solubility of Nitrogen in Al_2O_3 - CaO - MgO - SiO_2 Melts with Carbon Saturation in an Atmosphere of 50% N_2, 40% CO, 10% Ar at 1823 K

melt composition (mole%)				N Solubility		Number of Experiments
Al_2O_3	CaO	MgO	SiO_2	atomic %[a]	mass %	
12.1	39.8	7.3	37.8	3.04 ± 0.08	0.706 ± 0.018	20
12.15	32.55	14.55	37.9	2.87 ± 0.02	0.677 ± 0.005	5
12.2	35.15	14.7	35.6	2.34 ± 0.03	0.539 ± 0.007	4
12.3	40.3	14.7	31.0	1.68 ± 0.09	0.395 ± 0.021	16
12.3	43.4	14.8	28.2	1.29 ± 0.04	0.302 ± 0.09	6
12.4	41.4	7.45	36.2	2.49 ± 0.10	0.574 ± 0.024	10
12.4	47.0	14.8	24.7	1.04 ± 0.15	0.240 ± 0.035	12
12.5	46.7	7.5	31.5	1.80 ± 0.07	0.414 ± 0.015	6

[a] Definition is given by (No. of g-atom N)/(No. of g-atom N + No. of g-mol oxide).

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

N_2 + CO + Ar gas mixtures at nearly one atm. were passed over the samples contained in a carbon crucible at a rate of 5 ml/sec. After equilibrium was attained the samples were broken into pieces and analyzed for N by a similar method to that in ref. 1 (extraction method with oxidizing flux in a vacuum).

SOURCE AND PURITY OF MATERIALS:

High-purity SiO_2
"Analar" grade Al_2O_3; MgO; $CaCO_3$
CaO: made by thermal decomposition of $CaCO_3$ at 1373 K for 16 hrs.
Graphite crucible: high-quality electrode graphite
Ar = 99.995%
N_2 = 99.99%
CO = 97%, remainder N_2

ESTIMATED ERROR:

δ(mass)/(mass) = within ± 0.015 (Authors)

REFERENCES:

1. Chuchmarev, S. K.; Kamyshov, V. M.

   Zavodsk. Lab. 1964, 30, 1034.

SYSTEM INDEX

Page numbers preceded by E refer to evaluation texts whereas those not preceded by E refer to compilation tables.

REGISTRY NUMBER INDEX

Page numbers preceded by E refer to evaluation text whereas those not preceded by E refer to compiled tables.

AUTHOR INDEX

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