

PREFACE

This volume of the Solubility Series presents original data and evaluations of the solubility of methane gas in liquids. Collected here are the solubility data of methane in water, seawater, aqueous electrolyte solutions, mixed solvents, hydrocarbons, alcohols, ketones, carboxylic acids, esters, halocarbons, sulfur and nitrogen containing organic substances and other liquids at all temperature and pressures from papers published in the scientific literature through mid 1985. The publication of the methane volume completes the compilation and evaluation of the solubility data of the first five members of the alkane hydrocarbon series, C_nH_{2n+2} . The ethane solubility data are in Solubility Series Volume 9, and the propane, butane, and 2-methylpropane data are in Volume 24, both edited by W. Hayduk.

Methane melts at 90.68 K, boils at 111.42 K at 0.101325 MPa, and has critical temperature, pressure, and density of 190.55 K, 4.595 MPa and 162 kg m^{-3} , respectively. Some selected values of the second virial coefficient and methane molar volumes at 0.101325 MPa are:

T/K	$B/\text{cm}^3 \text{mol}^{-1}$	$V/\text{cm}^3 \text{mol}^{-1}$	T/K	$B/\text{cm}^3 \text{mol}^{-1}$	$V/\text{cm}^3 \text{mol}^{-1}$
115	-300.5	9,126	300	- 40.7	24,576
150	-176.2	12,130	350	- 25.5	28,694
200	-100.9	16,310	400	- 14.7	32,808
250	- 63.4	20,450	450	- 6.6	36,919
273.15	- 51.7	22,362	500	- 0.4	41,028
298.15	- 41.4	24,424	550	+ 4.4	-

The second virial constants and some of the other physical data above are from the International Thermodynamic Tables of the Fluid State, Volume 5, Methane, edited by S. Angus, B. Armstrong, and K.M. De Reuck, Pergamon Press, 1978. The methane molar volumes at 273.15 and 298.15 K are 0.23 and 0.17% less than the ideal gas values. The corrections for non-ideal gas behaviour have been applied in only a few cases of highly accurate gas solubility measurements.

Definitions of the many gas solubility units in use are covered in the introductory section on the Solubility of Gases in Liquids. Also discussed in the section is a thermodynamically consistent equation to use to fit the solubility as a function of temperature, and the thermodynamic changes that can be derived from the equation. The accuracy of most gas solubility measurements justifies use of only a two, or occasionally a three constant equation. These equations often require six to eight digits to properly reproduce a gas solubility value to three significant digits. When the equation constants are used to calculate thermodynamic changes the thermodynamic changes should be scaled back to no more than three significant digits.

In addition to the introductory section on the Solubility of Gases in Liquids the user will find helpful sections on Thermodynamic Considerations of Gas Solubility by E. Wilhelm, and on the Sechenov Salt Effect Parameter by H.L. Clever in Solubility Series Volume 10 on Nitrogen and Air. The original data is usually recalculated in several other units to better compare data from different sources. These unit conversions require density data which is not directly referenced except in special cases. Our most common source of density data is Organic Solvents, J.A. Riddick and W.B. Bunger, (Technique of Chemistry, Volume 11, A. Weissberger, Editor), Wiley-Interscience, New York, 1970, 3rd. Ed. The preface of Solubility Series, volume 1, Helium and Neon lists additional references for density data.

The editors renew their plea that authors publishing gas solubility data should always report the primary experimental observations of temperature, pressure, volume, etc., and that they should indicate the precise method used to calculate the solubility value. Much of the value of an Ostwald coefficient is lost if the pressure at which the measurement is made is not reported. Henry's constants have been defined and calculated in a number of ways and the precise significance of a particular value is often lost if pressure measurements are not given.

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