PREFACE

Mercury is a liquid metallic element of many useful applications. It is also an element with properties hazardous to the environment and work place, and corrosive to many materials. A knowledge of the solubility of mercury is useful in addressing problems requiring knowledge of the metal's concentration in the liquids and vapors of our surroundings.

The present volume of the Solubility Series presents all data published through 1986, June on the solubility of liquid mercury in water, aqueous electrolyte and nonelectrolyte solutions, hydrocarbons, alcohols, ethers, halocarbons, and nitrobenzene. The solubility of liquid mercury in molten and solid salts and in other elements is included as well as the solubility (enhanced vapor pressure) of liquid mercury in compressed gases.

The primary data are the solubility of liquid mercury in other liquids. By combining the solubility data with the mercury equilibrium vapor pressure, Henry's constant and Ostwald coefficients can be calculated. The Henry's and Ostwald solubilities not only give the solubility of liquid mercury in the solvent, but can be used to determine the mercury liquid-vapor distribution at pressures less than the equilibrium vapor pressure of liquid mercury. These measures of the solubility have been calculated in the evaluation of the mercury + water system. In principle they could be calculated for all of the mercury + liquid systems. The calculation assumes ideal gas behavior of the mercury vapor which appears to be justified at the low partial pressures usually encountered.

Mercury physical properties needed to convert to Henry's constant and Ostwald coefficients and to carry out other calculations of interest to scientists working with mercury are in the several appendixes. Included in these appendixes are various physical and thermodynamic data from several sources. There are density, vapor pressure, molar volume, enthalpy of vaporization, and solubility parameter of liquid mercury as a function of temperature, and the second viral coefficient of mercuy vapor.

A problem in evaluating the mercury solubility data was the effect of air (oxygen) on mercury. There is evidence that mercury may be oxidized by air in aqueous systems and possibly other systems. The evaluations are prejudiced in favor of workers that either used air (oxygen) free systems or traces of reducing agent to keep the mercury in a reduced state. In some papers it is not clear whether air was excluded or not, and some workers claim the effect of air is negligable. It is a point of some controversy which needs further work. Of course air is usually present in the environment, and the possible continous oxidation of mercury must be taken into account in the study of natural systems.

This volume is intended to compliment Solubility Series Volume 25, METALS IN MERCURY, edited by C. Hirayama, Z. Galus, and C. Guminiski. In the metals in mercury volume the mercury is the solvent for metals, while in the present volume the mercury is the solute in various liquids or gases. Data on a few of the mercury + other element systems may overlap in the two volumes, otherwise they are independent volumes.

We are aware of several on going studies of the solubility of mercury in liquids. There are new studies of the solubility of mercury in water at elevated temperatures and pressures, a redetermination of the solubility of mercury in some hydrocarbons and alcohols, and a projected study of the liquid-vapor distribution of mercury in hydrocarbon systems. The user will need to check for future publications of mercury solubility data to combine with the data summarized here.

H. Lawrence Clever

Atlanta, Georgia
1986, September

ACKNOWLEDGEMENTS

We thank the authors and publishers who have granted permission to reproduce figures and tabulated data from their copyrighted material. These include:

H. Kawahara, T. Yamada, M. Nakamura, T. Tomoda, H. Kobayashi, A. Saijo, Y. Kawata, and S. Hikari *Shika Rikogaku Zasei* 1981, *22*, 295 - 9, published by the Japanese Society for Dental Materials and Devices for the figure on page 100.

L. Haar and J. M. H. Levelt Sengers *J. Chem. Phys.* 1970, *52*, 5069 - 79, published by the American Institute of Physics for figures on pages 191, 193, 194, 196, 198, and 199.

N. B. Vargaftik, Tables on the Thermophysical Properties of Liquids and Gases, 1975, 2nd Ed. (Engl. Transl.) published by the Hemisphere Publishing Co., New York for mercury vapor pressure values tabulated in Appendix IV.

We thank Professor A. F. Voigt, Iowa State University, and Dr. S. Okouchi, Honsei University, for providing the experimental data reported in their papers as equations from linear regressions.

We appreciate the advice and encouragement of colleagues associated with IUPAC Commission V.8. Especially Steven Kertes, Mark Salomon, and Allan Barton, all of whom took and early interest in the preparation of the volume, and Colin Young who prepared the indexes. Although the present project had no outside support, it was initiated from the literature search for a project on the solubility of sparingly soluble mercury salts supported by the Office of Standard Reference Data of the US National Bureau of Standards. We are greatful for that support.

Last, but not least, I want to express my appreciation to Marian Iwamoto who helped compile the data, recalculated many solubility values, carried out numerous linear regressions, prepared figures, and then with a NEC APC III computer, WordStar, and a NEC Spinwriter typed and printed the camera ready manuscript.

HLC