

for the light diminution and that phosphorescence is being seen! Undoubtedly, the fact that the solution is exceptionally well scavenged for oxygen by the ion radicals makes an important contribution to the ability of this solution to phosphoresce at room temperature.

In acetonitrile the green emission is detected on oxidation of the phenanthrene anion as long as the potential does not reach the point where phenanthrene cation is generated (+1.8 v).¹⁰ The phenanthrene cation is exceedingly unstable; cyclic voltammetry employing rapid scan rates (60 cps) and displaying the current-voltage curve on an oscilloscope indicated that this cation has a lifetime of $<10^{-2}$ sec.

When the potential scan in acetonitrile is great enough to permit both oxidation and reduction of phenanthrene, the emission rapidly decreases in intensity, the solution yellows, and products are formed which are

(10) E. S. Pysh and N. C. Yang, *J. Am. Chem. Soc.*, **85**, 2124 (1963).

electroactive in the intermediate potential region. The spectrum of this emission, although too dim and variable for positive identification of the emitting species, appears to be the same as the preannihilative emission.

The dimness of this emission and the rapid darkening of the solution of phenanthrene in acetonitrile under such conditions raise questions as to the significance of the results previously reported for this system.¹¹

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(11) E. A. Chandross, J. W. Longworth, and R. E. Visco, *ibid.*, **87**, 3259 (1965).

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Book Reviews

Chemistry in Nonaqueous Ionizing Solvents. Volume I. Chemistry in Anhydrous Liquid Ammonia. Part I. Anorganische und Allgemeine Chemie in Flüssigem Ammoniak. By GERHART JANDER, Berlin, HANS SPANDAU, Braunschweig, and C. C. ADDISON, Nottingham. Interscience Publishers, John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1966. xxiv + 561 pp. 17 × 24.5 cm. \$27.50.

For several years publishers and colleagues have urged this reviewer to write a comprehensive treatise on the physical and inorganic chemistry of liquid ammonia solutions. Fortunately, this is no longer to be considered since the present volume meets the admittedly existing needs admirably.

This is Part 1 of Volume 1 of a series of monographs concerned with "Chemistry in Nonaqueous Ionizing Solvents;" Part 2 of Volume 1 was published earlier and covers organic reactions in liquid ammonia. The original editors of this series were the late Professor Dr. Gerhart Jander and Professor Dr. Hans Spandau. Upon the death of Professor Jander, Dr. C. C. Addison became a co-editor.

After a brief introductory section (4 pages) dealing with the preparation, purification, and handling of liquid ammonia, about 30 pages are devoted to a discussion of physical properties of ammonia. Although this section could have been much expanded, the present treatment provides both adequate orientation and entree to the literature. The longest part of the book, some 430 pages, is concerned with essentially all of the important aspects of solutions of inorganic substances in liquid ammonia; examples include vapor pressure data, molecular weight determinations, solubility relationships, electrode potentials, polarography, and thermochemistry. Particularly noteworthy is the section dealing with solutions of metals in ammonia. This includes both a concise review of the

relevant physicochemical measurements that have been made and a thorough review of the various models that have been proposed to account for these physical properties. Almost equally useful are the sections on acid-base relationships and oxidation-reduction processes. The third section covers the more recent literature, follows the same kind of subject matter organization, and is apparently an addendum.

Among the outstanding features of this monograph are: (1) the extent to which the authors have achieved conciseness without either loss of clarity or omission of important information; (2) the thoroughness with which the various sections are documented; (3) the extensive inclusion of equipment diagrams (albeit not always the best ones) and graphical representations of data; (4) the extensive recourse to data tabulation which makes the book especially useful for reference.

Seldom is one able to write about a book with so much enthusiasm; it is truly an outstanding contribution to the chemical literature. In its field, this volume will be the standard reference work for many years.

Errors are few, and they are of a nature (mostly typesetting) that does not lead to misunderstanding.

The price of the book (\$27.50) is discouraging—even in Texas where everyone has money except the poor folks.

Finally, in the English language version of the Preface, this reviewer was successively surprised and concerned to learn that "reference must be made to the collections of WATT, which have survived for over a century."

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