

be greatly hampered owing to the omission of free energy functions.

Table IV contains the computed boiling points at different pressures; Tables V–XXV contain the computed vapor pressures at even temperatures; and Table XXVI contains the computed vapor pressures at the melting points.

An interesting graph giving the pressure ranges of the experimental methods is presented on page 119, and another giving the pressure ranges over which the vapor pressure of each element has been measured appears on pages 394–395.

The book can be used in three ways, one of which is excellent, one very good, and one terrible. It should be an excellent source of information on vapor pressure methods, especially for those just entering the field. It provides a large and very useful bibliography, which, however, contains many errors. Its tabulated results should be used as they appear only by one who wishes numbers regardless of their reliability.

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Fused Salts. Edited by BENSON ROSS SUNDHEIM, Department of Chemistry, New York University. McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y. 1964. 435 pp. + ix. 16 × 24 cm. Price, \$18.50.

This is a valuable book for acquainting the scientist with the state of the art in most aspects of molten salts. It consists of seven reviews in various fields of fused salt research, each written by one or two authorities in the field. Most of the reviews discuss the results of the application of one broad discipline to the study of molten salts. In general, the authors assume the reader has more than an elementary acquaintance with the theory of the discipline. As a result, the book will be useful to the researcher in fused salts interested in results from the application of other disciplines than his own, or to the researcher who is concerned with the disciplines themselves and interested in their application to fused salts. This volume probably will have little value for the undergraduate student.

On the whole, the reviewer considers this to be a good book. It has the advantages that arise from being written by several authorities on the subject. The technical level is high, and the content reflects the latest thinking on the subject of molten salts. Most of the authors point out areas that would probably prove fruitful for further research—an attractive feature. Unfortunately, the book also has the disadvantages of a compilation of a set of review papers. There is a certain amount of duplication of effort, some of which is helpful, but some should have been edited out. Also there is a lack of consistency of the symbols used from one chapter to the next. This last is not serious, however, since the reader should be familiar with the various sets of symbols.

Chapter 1, "Structural Aspects of Ionic Liquids," by H. Bloom and J. Bockris, starts with a review of various theories of liquids as applied to fused salts. This is followed by a digression into transport phenomena, which might well have been left to the chapter on the subject. An interesting comparison is then made of the ability of the various theories to predict data. The closing section discusses evidence for identifiable species in mixtures and the meaning of complex ions in fused salts. This reviewer found it strange that the authors completely ignored the very important X-ray studies of pure fused salts.

Chapter 2, "Thermodynamic Properties of Fused-Salt Systems," by T. Førlund, is an excellent discussion of the subject. After a brief introduction the author derives the thermodynamics of mixtures for various structural assumptions. This is followed by a review of experimental methods. The concluding section covers experimental results and their significance regarding species and complex ions in melts.

In Chapter 3, B. Sundheim reviews "Transport Properties of Liquid Electrolytes." This starts at a very sophisticated level, but a persistent reader will find things get easier as he progresses. In fact, it might be recommended that the three sections of this chapter be read in reverse order. The last section, Discussion, is a very readable account of the concepts involved. The Experimental Methods section provides a compilation of data as well as a good description of methods. The first section on Phenomenolog-

ical Treatment discusses the application of the thermodynamics of irreversible processes to transport in molten salts and requires some background in the field for complete understanding.

"Electrochemistry in Molten Salts" (Chapter 4) by H. Laitinen and R. Osteryoung specifically excluded "static" electrochemical methods, presumably because this is well enough treated in other recent reviews. The authors discuss several comparatively new techniques from aqueous electrochemistry which have been applied recently to fused salts. These are primarily chronopotentiometry, impedance methods, pulse techniques, and polarography. The methods hold promise of providing information on the kinetics of electrode processes. To date, however, the results seem to be primarily diffusion coefficients of cations dissolved in fused salt solvents.

D. Gruen presents a very interesting account of "Spectroscopy of Transition Metal Ions in Fused Salts" in Chapter 5. In an introductory section he describes the spectra of salts that can be used as solvents. Then he gives an interesting discussion of the spectra of 3d ions in chloride melts—how the spectra give the symmetry of the field around the cation and hence the species or complex in which the ion exists. Results for 4f and 5f ions are subsequently discussed, but these are not so readily interpreted.

Chapter 6 is concerned with the "Solution of Metals in Their Molten Salts," and J. Corbett has presented an excellent review of this subject. An historical introduction is followed by a section on experimental methods. A discussion of experimental results follows. The final section presents the theories and models proposed to account for the properties of these solutions. The chapter reflects an effective survey of the literature for hard-to-find, pertinent references and the author presents a careful, impartial evaluation of the data. His closing quotation from Robert Frost seemed particularly appropriate.

Chapter 7, "Reaction Kinetics in Fused Salts," by F. Duke, is a brief review of a half-dozen of his own papers. The reader may feel that, by reviewing only his own work, the author is unduly egocentric. However, a little investigation will show that there is, indeed, very little other work except some studies of the decomposition of pure salts, and the author is justified in treating only his own papers.

It seems worthwhile to call the readers' attention to some recent, related books. "Molten Salt Chemistry" edited by M. Blander (Interscience Publishers, New York, N. Y., 1964) is a very similar compilation of several treatises by different authors. The book "Electrochemistry of Fused Salts" by Iu. Delimarskii and B. Markov, translated by A. Peiperl and R. Wood (Sigma Press, Washington, D. C., 1961), covers electrochemistry only. There is also a recent handbook of data on fused salts: "Physico-Chemical Constants of Fused Salts," edited by the Committee of Fused Salt Chemistry, The Electrochemical Society of Japan.

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Chemistry in Nonaqueous Ionizing Solvents. Volume IV. Chemistry in Lower Fatty Acids and Derivates. By KURT HEYMANN, HEINRICH KLAUS, HORST SURAWSKI, GERHARD WINKLER, HERBERT KNAUER, and LYLE R. DAWSON. John Wiley and Sons, Inc., 605 Third Ave., New York 16, N. Y. 1963. 313 pp. 17 × 24.5 cm. Price, \$12.00.

A voluminous literature exists in the area of nonaqueous solvent chemistry. This literature is scattered through many chemical journals, and the beginning worker is faced with a formidable task when he attempts to familiarize himself with previously published work in a given solvent. The series of monographs initiated by the late Gerhard Jander and by Hans Spandau and presently edited by Hans Spandau and C. C. Addison are designed to gather together in one place the literature pertaining to one solvent or a series of closely related solvents. This volume is fourth in a series "Chemistry in Nonaqueous Ionizing Solvents" and specifically concerns itself with the solvents formic acid, acetic acid, acetic anhydride, acetamide, and formamide and derivatives of amides.

Chapter 1 by Kurt Heymann and Heinrich Klaus, "Chemie in wasserfreier Essigsäure" (127 pp.), is an extremely thorough compilation of the acetic acid literature. Salient features of most of the articles discussed are given including much original data and figures. The material is presented systematically, starting with the discussion of the properties and preparation of acetic

acid and continuing with an extensive discussion of the physico-chemical literature which led to our present views of solutions in acetic acid. A convenient table of titrations performed in acetic acid is included.

Chapter 2, "Chemie in Essigsäureanhydrid" by Horst Surawski (70 pp.), has a pattern quite similar to the first chapter. Considerable conductance data are presented including the interpretation of phoreograms using Shedlovsky's modification of the Fuoss-Kraus method. A review of conductimetric, potentiometric, and indicated titrations is given. Also included is a summary of displacement and precipitation reactions.

Chapter 3, "Chemie in geschmolzenem Acetamid" by Gerhard Winkler (19 pp.), and Chapter 4, "Chemie in wasserfreier Ameisensäure" by Herbert Knauer (28 pp.), are considerably shorter than the preceding chapters. Both follow the patterns of the previous chapters and are of high over-all quality.

The last chapter, by Lyle R. Dawson, "Chemistry in Formamide and Derivatives of Amides" (40 pp.), is a comprehensive summary of conductimetric data and their significance. The author is well known for his contributions to this area.

As in all books of such wide scope, omissions have occurred. A discussion of photometric and thermometric titrations in *glacial acetic acid* is absent. In Chapter 5 no discussion of acid-base titrations or polarography is given. These and other minor omissions detract slightly from this book's value.

The editors and authors of this volume have filled a void in the nonaqueous chemical literature and have produced a book which will undoubtedly find its way into the libraries of those seriously interested in this field.

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Experimental Methods in Gas Reactions. By SIR HARRY MELVILLE and B. G. GOWENLOCK. St. Martin's Press, Inc., 175 Fifth Ave., New York 10, N. Y. 1964. 446 pp. + vii. 15.5 × 22.5 cm. Price, \$17.00.

Workers in the field of gas reactions are familiar with the book by Farkas and Melville, "Experimental Methods in Gas Reactions." New materials of construction, commercial equipment and components, and experimental techniques in the 25 years since this book was written have made necessary this revision. The authors claim that about half of the book consists of new material, and half contains standard information from the first edition which is of value. The book is divided into broad sections on kinetic theory of gases, pressure control and measurement, temperature control and measurement, the preparation and purification of gases and volatile compounds, gas analysis, photochemical techniques, and a concluding general chapter on the assembly of assorted varieties of apparatus. Material on classical (pregas chromatography) gas analysis is still retained in detail because the authors felt that in some instances these techniques may be more convenient or accurate than chromatographic techniques; there do not exist separate recent works listing these methods in detail for the benefit of people new to the subject. Gas chromatography warrants only about six pages of discussion, probably because there are numerous small and large books now available on the subject. The same is true for mass spectrometry. Many drawings and more detailed discussions are found of special techniques and apparatus which would not be obvious or readily found elsewhere by a person who is not already conversant with the material. An example of such an item is the inefficiency of many common cold traps in the trapping of samples from the effluent gas of a gas chromatography; this is not mentioned in many sources on gas chromatography, although it is found here. Probably the greatest value of the book is the utility as a catalog for a tremendous number of references for items or methods which can only be cited in passing in the text. The equipment items and manufacturers mentioned are almost solely of British origin. The knowledge that an item is available commercially in another country usually encourages the interested experimenter to look for a more readily available domestic counterpart, so this is not a serious hindrance in the use of the book.

The authors are to be commended for their work.

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The Mitochondrion. Molecular Basis of Structure and Function. By ALBERT L. LEHNINGER, Department of Physiological Chemistry, The Johns Hopkins University School of Medicine. W. A. Benjamin, Inc., 2465 Broadway, New York 25, N. Y. 1964. 263 pp + xx. 16 × 24 cm. Price, \$9.00.

This monograph is first of a series in microbial and molecular biology, designed, as stated in the foreword and preface, to present a comprehensive review in broad perspective that will permit the advanced student or research worker to obtain an up-to-date grasp of an actively developing area without having to refer extensively to original papers. It was also the intent to present not an exhaustively documented classical monograph but an easily readable account of many contributions and points of view, coupled with additional interpretations and speculations about developments in the future.

This book does a remarkable job of accomplishing just what is proposed by the editor and the author. The narrative account is thoroughly and easily readable, with clear exposition. The description of the past history, the analysis of our present knowledge, and the looks into the future are well done. One may disagree with some speculations or not favor some given considerable space by the author, but they are all worth careful consideration. The author presents some imaginative ideas and has a keen sense of what may be a significant lead. He has pointed out many of these in his interesting discussions of problems to be faced. There is only an occasional uncritical evaluation of a correlation and essentially no omissions. Possibly there could have been a little more speculation concerning the ferredoxin type of enzyme (non-heme Fe) as an area for future development.

The book should be very useful for students, and it is a wonderful book for the experienced person to use in broadening his appreciation, refreshing his memory, or as a lead back into literature on less familiar points. A careful reading of the foreword and preface should prevent anyone from being misled seriously by any unwarranted generalizations. Although the author clearly understands the importance of separating fact from speculation (p. ix), in such a narrative account it is difficult to avoid a mistake we all commonly make. Many correlated facts are cited as if cause and effect had been thoroughly established, although other explanations may exist. Although this might be slightly misleading to the inexperienced, we must weigh against this possibility the considerable probability that the suggested relationships are close to the true ones. As in any field where developments are rapid, some speculations may be out of date by the time a book gets into print.

The danger that a book of this type might present a decidedly one-sided point of view and interpretation has been avoided. As is to be expected in this type of account, the author at times draws heavily on the work of his own laboratory, but the full picture is completed with accounts of the work in other laboratories. Areas in which there has been considerable controversy are summarized and discussed with a clarity and brevity that should be most rewarding for the reader not actually working in the field. In considering his own work, the author makes several excellent analyses about what has and has not been proven by the experiments to date; for example, the contraction of mitochondria by added ATP.

Especially good or timely chapters are those on mitochondria in the intact cell, controls that may function in the citric acid cycle (such as the list of all possible reactions of oxalacetate on p. 146), and the origin of mitochondria. There is a good brief summary of the implications in one or two electron-transfer mechanisms in the respiratory chain (p. 117), and the explanation for considering reduced as well as oxidized carriers as high energy intermediates should help many who have not fully grasped the suggestions of B. Chance (pp. 120-125).

The bibliographic references, separated into reviews and a limited number of selected original papers, do serve admirably as starting points for anyone wanting to enter the literature to investigate some point in greater detail. Not only is the complete title of the paper included, but a word or two of comment in some cases lets the reader know which reference deals unusually well with a certain point, and whether papers in foreign journals are in English. The index is adequate; the table of contents, with the subheadings in all of the chapters, is very useful.

As in all books some errors have crept in. The usual minor ones, such as listing DNP as an electron-transport inhibitor (p.