BOOK REVIEWS

Thermodynamic auf den Grundlagen der Quantentheorie, Quantenstatistik und Spektroskopie. Dritter Band. Ergebnisse in tabellarischer und graphischer Form. 1. Hälfte: Tabellen. By H. ZEISE. S. Hirzel Verlag, Schuhmachergässchen 1–3, Leipzig, Germany. 1954. xl + 311 pp. 17.5 × 24.5 cm. Price, DM 20.

Thermodynamik auf den Grundlagen der Quantentheorie, Quantenstatistik und Spektroskopie. Dritter Band. Ergebnisse in tabellarischer und graphischer Form. 2. Hälfte: Graphische Darstellungen und Literatur. B. H. ZEISE. S. Hirzel Verlag, Schuhmachergässchen 1–3, Leipzig, Germany. 1957. 299 pp. 17.5 × 24.5 cm. Price, DM 22.20.

The first of these two volumes gives values of thermodynamic functions for a wide variety of substances, mostly gases. The values are those calculated using the methods of statistical mechanics. This volume was completed after the death of Dr. Zeise by his colleague Dr. Frinz Matthes and is a continuation of two previous volumes. It consists of a brief description of the methods used in the calculation of the thermodynamic functions from statistical mechanics and molecular data and of tables of calculated values of the functions. While the substances for which values are given are too numerous to list, an idea of the material covered can be gained from the table of contents which follows:

Introduction: (1) The basical general formulas for the theoretical function values. (2) A short review. (3) The inner state of free atoms. (4) The inner state of free molecules. (5) *Ortho-para*-modification of hydrogen and other "nuclear-spin-isomers." (6) Dissociation and ionization equilibria in gases. (7) The equation of state and thermodynamical functions for gas mixtures which are produced through dissociation or ionization equilibria. (8) Relaxation.

Tables of Values: (I) Molar specific heat C_p^0. (II) Molar thermal enthalpy, $(H_T^0 - E_0^0)$. (III) Molar entropy, S_T^0. (IV) Molar free energy-function $G_T^0 - E_0^0)/T$. (V) Thermodynamic functions for some condensed substances. (VI) Gas equilibria. Appendix: Tables VII, VIII and IX. (X) Supplement. Name index and subject index.

Besides for the elementary and simple gases, values are given for organic vapors with as many as twenty carbon atoms. Values are given for condensed elements and certain solid substances (oxides, salts, etc.).

The second of the volumes contains graphs of equilibrium constants for certain gaseous reactions as a function of the temperature and a summary of the literature up to 1953 on which the data given in the previous volume are based. It was completed and edited by Hans-Jürgen Knopf after the death of Dr. Zeise.

The volumes cover data the equivalent of which has been largely published in the United States (for example the tables of the American Petroleum Institute) Even so they seem a useful, if not necessary, addition to any reasonably complete chemistry library.

DEPARTMENT OF CHEMISTRY
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Interscience Monographs in Physics and Astronomy. Edited by R. E. MARSHAK, University of Rochester. Volume II. Radiation Effects in Solids. By G. J. DIENES, Department of Physics, Brookhaven National Laboratory, Upton, New York, and G. H. VINEYARD, Department of Physics, Brookhaven National Laboratory, Upton, New York. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1957. viii + 226 pp. 15.5 × 23.5 cm. Price, $6.50.

The systematic study of structural changes produced in solids by energetic radiation has proceeded rapidly since the development of nuclear reactors focused attention on the problem as one of considerable technological importance as well as of fundamental interest for the theory of solids; the literature in this field has been particularly active since the Geneva Conference of 1955 provided the occasion for publication of much wartime and postwar research hitherto classified. The present volume is one of the first treatments of the subject to appear in book form. It surveys the progress that has been made in understanding the fundamental physical processes of radiation damage, primarily those effects that arise from the displacement of atoms as opposed to ionization or purely electronic excitation. The central problem is the development of a quantitative description of the displacement processes which would permit calculation of the number and variety of lattice defects produced by a given bombarding particle—electron, nucleon, fission fragment or γ-ray photon—of given energy, together with a theory of the influence of such defects on the macroscopic properties of the solid which would permit quantitative evaluation of the radiation damage. Roughly half of the book (Chapters 2 and 3) is devoted to the basic theory of displacement production and analysis of those experiments which provide more or less direct measures of the yields and energy thresholds for atomic displacements. Theories of the production of lattice defects and of their macroscopic effects are approximate in character, subject to minor individual differences of interpretation, and the treatment here is one of fairly detailed review and summary of the alternative theoretical models rather than didactic exposition of a unique point of view. Chapter 4 deals with the effects of atomic imperfections on a wide range of physical properties: electrical and thermal conductivity, optical absorption, elastic behavior, and others. Chapter 5 treats the problem of annealing, applying the theory of diffusion of point defects to experimental observations of radiation damage recovery and release of stored energy brought about by warming samples irradiated at low temperature. The final chapter is reserved for brief descriptions of more complex or specialized effects less amenable to quantitative interpretation but of obvious interest: the drastic dimensional changes of irradiated uranium, for example, perhaps the most spectacular and impressive demonstration of radiation damage. Several chemical effects more or less peculiar to solids are also discussed here: decomposition of inorganic salts, manifested in the crystalline materials by coloration, density changes, etc.; radiation-induced polymerization, in crystalline monomers such as acrylamide; and radiation effects on reaction rates, the latter including one instance, the accelerated oxidation of neutron-irradiated graphite, in which the effect is distinctively a result of atomic displacement rather than ionization.

The bibliographical documentation throughout the book is both extensive in scope and generous in the information provided (including titles of papers in full). While the authors' viewpoint is that of the solid-state physicist, and the main emphasis on the microscopic processes of radiation damage, the experimental background is presented in sufficient detail, particularly in Chapter 4, to provide for the non-specialist reader a well-rounded picture of the nature and variety of the macroscopic effects and a feeling for the magnitudes involved.

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Pure and Applied Physics. Volume 1. Electron Impact Phenomena and the Properties of Gaseous Ions. F. H. FIELD AND J. L. FRANKLIN, Refining Research and Development Division, Humble Oil and Refining Company, Baytown, Texas. H. S. W. MASSEY, Consulting Editor, University College, London, England. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. ix + 349 pp. 16 × 23.5 cm. Price, $8.50.

The authors have "tabulated and where possible interpreted all available energetic data pertaining to electron impact phenomena." This is certainly a useful contribu-

tion to the literature and is sufficient reason for persons interested in the field of mass spectrometry to acquire this book. The appendix contains an exhaustive survey of critical potential data covering the literature from 1930–1955 inclusive. The associated bibliography of 534 references indicates the magnitude of the effort involved in this work.

The main text of the book contains chapters on Apparatus and Methods, Theory, Energetic Considerations, Mass Spectral Considerations and Implications for Chemical Reactions. The first chapter is specifically designated to the discussion of appearance potential determinations and related techniques and serves this purpose. The chapter on Theory misses an excellent opportunity to indicate the limitations of usefulness of the quasi-equilibrium theory which arise from difficulties in getting precise and reliable appearance potential data. In the reviewer's opinion one of the most important applications of critical potential data is found in studies of the quasi-equilibrium theory of mass spectra.

The chapter on Energetic Considerations shows the limitations of appearance potential data. This topic is difficult to treat clearly and objectively and the authors often yield to the natural temptation to emphasize their own results.

On the point of clarity of exposition, if future editions of this book appear revision of passages of the following type would be helpful. "In discussing various ionic organic reactions, obviously the proton affinity of a molecule is the energy evolved when a proton is added to a molecule to form an ion. Since a proton is an entity of very high energy, proton affinities are usually comparatively high and, of course, so are strengths of the bonds involving the proton."

In spite of the objections noted above on clarity and the manner in which some data are presented, the reviewer recommends this book as a useful refcrence work.

DEPARTMENT OF CHEMISTRY
BROOKHAVEN NATIONAL LABORATORY LEWIS FRIEDMAN
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International Committee of Electrochemical Thermodynamics and Kinetics. Proceedings of the Seventh Meeting. Lindau, 1955. G. VALENSI, Poitiers (Editor-in-Chief), T. P. HOAR, Cambridge, F. JOLAS, Paris, and J. O'M. BOCKRIS, Johannesburg. Butterworths Scientific. Publications, 88 Kingsway, London, W. C. 2, England. 1957. xi + 409 pp. 16.5 × 25.5 cm. Price, 84 s., by post 1s. 6d extra.

The papers, the discussions, and the business of the seventh meeting of CITCE at Landau, Germany, in July, 1955, are contained in this volume. At the outset it must be noted that the value of the proceedings must have been diminished by the 27 months which elapsed before they appeared in print. This is not only a disservice to the authors of the papers making up most of the book but also to the readers who did not have access to some of the fine work contained in these papers. Delay in publication of proceedings of meetings and symposia seems to be widespread (see for instance *Science*, 126, 704 (1956), for a review by Hoilge), and some effort is needed to overcome this problem. It may be that the excessive delay stems from the inclusion of the discussions. If so it would be well worthwhile considering eliminating the discussion from the volume and printing it as a separate pamphlet to be distributed at a later time. In this volume the discussion was surprisingly meager, especially in the sections on experimental methods and on semi-conductor electrochemistry.

There are six sections of major interest in the book. These are: Experimental Methods in Electrochemistry; Fundamentals, Electrochemical Definitions; Potential–*p*H Diagrams; Corrosion and Protection against Corrosion; Batteries and Accumulators; and Electrochemistry of Semi-conductors. Of the 33 paper titles listed, eight are essentially notes and three are simply abstracts. Approximately a quarter of the book is given over to the business of the meeting, to introductory summaries of the papers in each section, and to reports of the several Commissions of the organization. Among the last is an interesting introductory report by Pourbaix on electrochemical kinetics. This report and the resulting discussion led to the formation of a Commission on Electrochemical Kinetics which was charged first with assembling presently available information in that field of interest.

In spite of what may sound like a discouraging report up to this point this volume does contain good papers, some largely review, but all of generally high caliber. A group of six titles is devoted to up-to-date reports and reviews on the electrochemistry of systems with solid state conductors. Following a survey by Madelung on the nature of the semiconduction single phase, using both band theory and the atomic picture used for ionic crystals, there are two papers concerned with the complications introduced in multiphase systems of this sort. Schultz and Harten concern themselves with semi-conductors in contact with a gas phase and with a metal, while Seiler and Geist treat the case of semi-conductors in contact with other semiconductors. The former have a particularly interesting section on surface properties of semi-conductors but the entire group, while largely review, is good. Wagner provides an outstanding paper on galvanic cells using solid electrolytes. It is largely theoretical, drawing heavily on data and experimental information already in the literature. Milička in an abstract gives a tantalizing look at a possible procedure for measuring the phase potential of semi-conductors (and insulators) in powder form. If truly applicable, this opens some interesting possibilities such as its use in potentiometric measurement of adsorption onto powders, as suggested by the author. The section is closed by a paper by Gölr in which he draws the parallel between potentials in electrochemistry and in semi-conductor work. This is done in a clear and concise fashion.

The largest single section of the book consists of 15 titles devoted to experimental methods in electrochemistry. This is one section which would have served a much better purpose had it appeared earlier. Much of it is in the nature of review but a considerable portion describes new and useful procedures. Disregarding the question of new material *versus* review and survey, the papers by Gierst on constant current density electrolysis, especially using interrupted and periodic inputs, by Seipt on galvanostatic and potentiostatic methods, and by Ibl on investigative methods for the diffusion layer are first rate and likely to be very useful to many workers in electrochemistry. The paper by Epelboin, Brouillet and Froment on measuring large anode potentials in concentrated electrolyte solutions should be of particular interest to those working on anodization, on electropolishing, and to some extent to those concerned with the passivity of metals. Grüss's paper on the use of brightness measurements to study metal surfaces is a short review of limited usefulness. Rius, Llopis and Sanchez-Robles describe a mercury jet cathode as another in the arsenal of polarographic techniques. They point out the disadvantages of the method and state that it provides an interesting system in which a particular advantage is its use for preparative purposes, thereby permitting one to study the kinetics of electrochemical reductions by normal analytical means. There are two other original papers of somewhat more restricted interest. De Greef, Decroly and Boute studied the effects of additions to the solution on deposition potentials of alloys, specifically Cu-Zn; Nagel describes an investigation of the mechanism of "haze" formation in the electrolytic production of silver halide electrodes. A theoretical treatment of some interest concerning the elimination of diffusion potentials was contributed by Maroncy and Valensi, and Lange made some succinct comments concerning Volta potential drops and the advantage of using the condenser method for measurement of these potentials. A paper on electrolytic oxidation and reduction by Lewartowicz is concerned generally with the influence of various experimental parameters on the interpretation of kinetic results. The remaining four titles are brief notes or abstracts.

The question of electrochemical definitions and signs of electrode potentials is dealt with in a short section containing five notes. Much of this material has been seen before but it is of interest in two respects. A note on The Sign of Half-Reaction Potentials by Latimer (probably his last) shows that he was willing to use the so-called European sign convention in order to destroy what is certainly an undesirable, and probably unnecessary, roadblock. Gerischer's brief paper on notations of current–potential curves is certainly timely.

Potential–*p*H behavior for the systems Ni–H_2O and Sn–H_2O is detailed thoroughly by Pourbaix, Zoubov and Deltombe in two papers. Aside from the equilibrium infor-