BOOK REVIEWS

Advanced Mechanics of Fluids. Edited by HUNTER ROUSE, Iowa Institute of Hydraulic Research, State University of Iowa, Iowa City, Iowa. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1959. xiv + 444 pp. 16 × 23.5 cm. Price, $9.75.

This book is a companion volume to an earlier text, by Hunter Rouse, entitled "Elementary Mechanics of Fluids" and was written by members of the Iowa Institute of Hydraulic Research at the State University of Iowa, under the editorship of Hunter Rouse. As the title indicates, the book is concerned with the mechanics of fluid motion from an engineering viewpoint. The discussions in general are concerned with the basic problems and not usually with the solution of specific engineering problems.

The text opens with an interesting discussion of the author's views on the interrelations of theoretical and experimental studies and some comments concerning the present status of the theory of fluid mechanics. This is followed by a chapter on the fundamental concepts and equations. Here the equations of continuity and motion are presented in considerable detail. It is interesting, however, that no mention is made of the concept of temperature or of thermal conductivity. Since this is a discussion of the mechanics of fluid motion and in almost all applications the temperature can be assumed constant, this omission is perhaps justifiable. It is, on the other hand, hard to understand how this point can be ignored completely in a description of the fundamental concepts.

There are then several very excellent chapters on the basic mathematical methods of solving the equations under various special conditions. The book concludes with chapters on boundary layer theory and turbulence.

The book is well written and brings together a great deal of information on fluid mechanics. It is a valuable reference book as well as a text for advanced courses in fluid mechanics.

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Semiconductors. American Chemical Society Monograph No. 140. Edited by N. B. HANNAY, Bell Telephone Laboratories, Murray Hill, New Jersey. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1959. xxiii + 767 pp. 16 × 23.5 cm. Price, $15.00.

This is another in the rapidly growing list of books on solid state physics, and particularly in the semiconductor field. This one is unique in that it emphasizes the chemical aspects of the field, and is written partly by, in the language of, and for the benefit of chemists.

The important contributions of both chemistry and physics to the field of semiconductors are well recognized. Not so well known, perhaps, is the difference in point of view taken by these two groups. A thought-provoking statement, to a physicist, appears in the introduction to the second chapter, "Although the primary emphasis in much of this book is given to the interpretation of chemical phenomena observed in semiconductors, a broader point of view should be kept in mind. The study of semiconductors has added enormously to our knowledge of the chemistry of solid solutions." This is an interesting idea which might not occur to a physicist, who would be more likely to say, "Physics has added enormously to our knowledge of semiconductors."

This book, or rather compilation, consists of 17 chapters, written by authorities in their respective fields. A greater unity is preserved than in most collections of review articles, and the notation is consistent throughout. The first chapter (Hannay) is entitled "Semiconductor Principles," and summarizes some of the physical concepts involved. Chapter 2 (Lander) is a "Survey of Semiconductor Chemistry." Chapter 3 (Tanenbaum) reviews "Semiconductor Crystal Growing," and chapter 4 (Thurmond) discusses purification techniques under the title "Control of Composition in Semiconductors by Freezing Methods." Chapter 5 (Fuller) is devoted to "Defect Interactions," chapter 6 (Reiss and Fuller) to "Diffusion Processes," chapter 10 (Hrostowski) to "Infrared Absorption," chapter 11 (Shulman) to "Recombination and Trapping," chapter 16 (Law) to "Surfaces," and chapter 17 (Dewald) to "Semiconductor Electrodes." Chapter 7 (Thomas) discusses "The Chemistry of Some Compound Semiconductors." "Group IV Semiconductors" are treated as a class in chapter 8 (Geballe), and the III-V's and a few others are covered in chapter 9 (Whelan). Oxides and sulfides are the subject of chapter 13 (Hutson), the special properties of the oxides of the 3d transition metals are discussed by Morin in chapter 14, and organic semiconductors are treated in chapter 15 (Garrett). Imperfections in Ge and Si, including dislocations, are the subject of chapter 12 (Hobstetter).

The discussions of most topics are reasonably up-to-date, though the new material presented at the International Conference on Semiconductors, Rochester, 1958, is not generally included.

The purpose of the book is to emphasize the chemical aspects of the field for workers in this branch of solid state science, and this goal is attained. Another stated objective is to satisfy the requirements of graduate students, or chemists working in other fields, who wish to learn something about the field of semiconductors. Most of the latter group will probably have difficulty in understanding some of the theoretical aspects, in which a considerable background is assumed.

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Nuclear Reactions. Volume I. Edited by P. M. ENDT, University of Utrecht, and M. DEMEUR, Université Libre de Bruxelles. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. xii + 502 pp. 16 × 23 cm. Price, $12.50.

Most of the information which we have about nuclei and most of our general ideas about nuclear structure stem directly or indirectly from a study of nuclear reactions. During the past ten years in particular our entire notion of how a nuclear reaction proceeds and how in general a nucleon interacts with a nucleus has changed. We know now that the interaction between nucleons in a nucleus is not really strong as had been supposed by Bohr when in 1936 he founded his compound-nucleus theory of reactions; many nuclear reactions for example are explainable as direct interactions (one-step processes instead of the two-step reaction of the compound-nucleus theory), and the essentially weak interaction responsible for this is directly correlated with the weak interactions exhibited in the nuclear shell model. Experimental techniques have of course also improved enormously and one now seeks, for example, by measuring angular distributions and angular correlations, to learn quite subtle things about nuclei.

The present book, the first of two volumes, is really the first book to be devoted to this exciting field. The only other comprehensive account is contained in the recent "Handbuch der Physik" volumes and there is fortunately not too much overlap between them since the Handbuch articles cover a wider field and are mostly by different authors. It might be noted however that two of the articles in the present book are written by people who are coauthors of essentially similar, though longer, articles in the two Handbuch volumes which the reviewer has seen.

The book contains ten articles, all of them written by very competent people. One of the articles, perhaps the best written of the ten, concerns the theory of the nucleus as a many-body system and describes the recent advances made in producing a really sound theoretical basis for the various models. Three of the articles are about nuclear models, the shell model, the collective model and the statistical model. The last of these really concerns nuclear reactions since the

statistical model is more nearly a model for a reaction than it is for nuclear structure; but the first two pay very little attention to reactions. An excellent pair of articles considers resonant reactions from an experimental and from a theoretical viewpoint. Three articles are devoted to reviews of experimental results including an interesting account of the experiments being done with heavy-ion accelerators. One article is devoted to the modern formalism of angular correlations and polarization.

For the most part the different chapters are not well correlated with each other and the book must be viewed as a collection of separate papers. Since, with one or two exceptions, the articles are well written and stimulating, the book, judged in this manner, is altogether successful; it will appeal both to the student and to the research worker who wants an authoritative, but for the most part not too technical, account of nuclear reactions. With the second volume we will presumably have a rather complete account of the subject.

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Electroanalytical Chemistry. Second Edition—Revised and Enlarged. By JAMES J. LINGANE, B.Chem., Ph.D., Professor of Chemistry, Harvard University. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1958. xiv + 669 pp. 16 × 23 cm. Price, $14.50.

This book makes a rather comprehensive survey of the field of electroanalytical chemistry, both classical and modern. Included are chapters on potentiometry, conductimetry, polarography, controlled potential electrolysis, coulometry, and chronopotentiometry.

The second edition differs from the first primarily in that it is intended to be used as an advanced text rather than as a reference book. New chapters have been added dealing with electrical measurements, polarography, amperometry and chronopotentiometry. The material dealing with coulometry has been extensively revised and brought up to date.

The style is fluent, and the new material has been blended skillfully into the old. The treatment is authoritative. Much of the book is on the level of an advanced textbook, and the discussion is fairly general. However, the chapters dealing with coulometry and controlled potential electrolysis are more in the nature of excellent monographs.

Some sections of the book may be criticized for unevenness of treatment, particularly the chapters on electrical measurements and polarography. But it is hard to see how this could be avoided without unduly expanding the book. One of us is currently using this book as a text, with satisfactory results.

Professor Lingane has rendered a real service in preparing this authoritative survey of a field for which no comparable textbook exists.

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Nuclear Spectroscopy Tables. By A. H. WAPSTRA, G. J. NIJGH and R. VAN LIESHOUT, Institute for Nuclear Physics Research, Amsterdam. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1958. vii + 135 pp. 20 × 27 cm. Price, $8.90.

This book is indeed quite puzzling; the puzzle concerns the audience for which it was written. It is clearly not written for the non-expert in the field of Nuclear Spectroscopy, for the treatment of the topics is so cursory as to make most of the tables all but useless for the individual who is not steeped in the subject. On the other hand, the introduction is useless for the expert who is quite familiar with the material and is in fact for him quite trite. Indeed, those sections of the book which would be readily understandable are essentially trivial.

The book is divided into ten chapters. The first "Mathematical Data" has (for reasons incomprehensible to the reviewer) tables of four-place logarithms, powers of ten, powers of two and cube roots. The chapter is rounded out by two subsections on the least squares method and quadratic interpolation followed by cursory tables of the Gaussian distribution and χ^2. If the book has a highlight it is the section on the least squares method which is written in a delightfully airy vein (it is also understandable). The first chapter is followed by one on "Atomic Constants" which has a short listing of the same—one should be careful here of the MKS system which really seems out of place in the atomic domain. This is followed by a chapter entitled "Elements and Isotopes" containing information readily available in 1001 other places. Chapter 4 on "Heavy particles" contains useful (but readily available in more complete form elsewhere) data on the ranges and magnetic rigidities of protons, deuterons and α-particles. The fifth chapter entitled "Electrons" is devoted principally to a discussion and tabular presentation of data relevant to β-decay and K-capture. The next chapter on "Gamma Rays" is devoted to a cursory discussion of proton absorption, γ-decay half-lives and internal conversion. The seventh chapter on X-Rays and Anger electrons has quite conventional data. Chapter eight on "Angular Distributions and Correlations" is completely unintelligible to the uninitiated and not in the best form for the initiated. The next to last chapter on "Nuclear Models" is a hodgepodge of items for which there did not seem to be any logical place elsewhere and the last chapter, "Calibration Standards" is an excellent example of presentation of facts well known to the expert and in non-usable form for the non-expert.

It is really not clear why this book was written, for fully at least 75% of the material presented is in the working library of any physicist (or readily available to him) concerned with nuclear physics. The remaining 25% which is of use only to the specialist is surely already in his possession. It does not appear to me that the argument of compactness of this information is sufficiently strong to warrant the investment. It should be noted that the physical make-up of the book is excellent.

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Elements of Heat Transfer. Third Edition. By the late MAX JAKOB, Research Professor of Mechanical Engineering, Illinois Institute of Technology, and GEORGE A. HAWKINS, Dean of Engineering, Director, Engineering Experiment Station, Purdue University. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1957. xxv + 317 pp. 16 × 23.5 cm. Price, $6.75.

In 1950, Jakob and Hawkins introduced a second edition of their short monograph "Elements of Heat Transfer and Insulation," in which, as the authors declared, the revision consisted of lengthening, detailing and increasing the complexity of certain sections without altering the content or arrangement of the book fundamentally. Apparently much the same attitude has occupied Dean Hawkins in his preparation of a third edition; extensions of the text and new problems have been added, insulation has been de-emphasized (the term has disappeared from the title), and a chapter on mass transfer has been appended, but the book is basically unchanged. Thus it retains most of the advantages of its earlier editions and most of the defects as well. In some cases the new advantage of added material is at least partly off-set by the disadvantage resulting from tacking the new material loosely to the old text instead of integrating it into rewritten text. An example is provided in the chapter on fluids in turbulent flow through pipes: a short section on liquid metals is a proper addition; less than proper, however, is the inconsistency of reading in preceding unrevised passages that the Dittus–Boelter equation is applicable to any fluid, only to learn two pages later that the authors really meant any fluid except a metallic one.

Among the special assets of the book are the following: the inclusion of such bits of modernity as convective heat transfer to liquid metals, the behavior of fluids at Mach number $\geq$ unity, and the application of electrical analogs to heat transfer calculations; the simple development of special forms of the integrated Fourier equation, and detailed elaboration (by example) of relaxation methods; an analysis and explanation of finned surfaces; a very good précis of heat transfer by radiation; direction of the reader to the problems of measuring conductivity and emissivity, and to the general difficulty encountered in temperature measure-