this feature. The value is reduced, however, by the large number of typographical errors which are scattered throughout the book and references.

A second valuable contribution which might well be expected from such a book is a critical discussion of the collected data. In a few instances this has been given. The discussions on deuterium solvent isotope effect and on intrinsic migration aptitudes, for example, are clear, concise and cogent. Much of the reporting, however, is uncritical and occasionally observations which are open to serious question are presented without editorial comment. A fairly broad grounding in theoretical organic chemistry on the part of the reader is assumed. Because of these two circumstances, the book cannot be recommended for the unsophisticated student of organic chemistry. The drawbacks are less serious for the advanced worker or specialist who intends to use the book as a guide to the literature of isotopic tracing through 1952.

MELLON INSTITUTE
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Gmelins Handbuch der Anorganischen Chemie. Platin. Teil D. Komplexverbindungen mit Neutralen Liganden. System-Nummer 68. E. H. ERICH PIETSCH (Editor). Verlag Chemie, G.m.b.H., Weinheim/Bergstr., Germany. 1957. lix + 638 pp. 18 × 25.5 cm. Price, $90.00.

This is the final portion of the treatment of the element platinum. It covers, through 1953, the literature on complex compounds of platinum with neutral ligands. Following 38 pages of general introductory discussion, 425 pages deal with complexes of divalent platinum and 150 pages with those of the quadrivalent element. Compounds containing both divalent and quadrivalent platinum, divalent palladium and quadrivalent platinum and platinum organic compounds not containing neutral ligands occupy the remaining 15 pages. There is a convenient index in which the complexes are classified by the kind and number of ligands.

There is every evidence that the encyclopedic coverage characteristic of other parts of the great Handbuch has been maintained in this volume.

NATIONAL BUREAU OF STANDARDS
WASHINGTON, D. C. EDWARD WICHERS

Elements of Classical Thermodynamics for Advanced Students of Physics. By A. B. PIPPARD, M.A., Ph.D., F.R.S., Lecturer in Physics in the University of Cambridge and Fellow of Clare College, Cambridge. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1957. vii + 165 pp. 14.5 × 22 cm. Price, $4.75 (cloth); $2.75 (paper).

Pippard attains the fine level of excellence one is accustomed to find in books from the Cambridge University Press. Succinct but not brief, thorough but not boring, instructive but not pedantic describe the general tenor.

In the author's words, ". . . this is probably not a suitable textbook for the beginner, but I hope the more advanced student will find here a statement of the aims and techniques which will illuminate any specialized applications he may meet later." Both the text and the set of 14 rather difficult exercises are gauged for this level.

Little mention is made, as the title would indicate, of statistical ideas. The first three laws are stated and developed from a classical viewpoint, and then applied to many of the most interesting simple systems and their changes. Little attention is paid to chemical systems and changes as such, for the book is written largely for students of physics and mathematics. Applications to adiabatic and isothermal changes, to phase equilibrium, to radiation, to magnetic fields, to phase transitions of various orders, are well done. The thermodynamic inequalities concerning the increase in entropy, the decrease in availability (free energy), and the conditions of equilibrium are given good coverage.

The terminology is, of course, not that used in this country. Perhaps the book should be read by American students just to acquaint them with the provincialism of our scientific language. It might also remind ever more Americans of the desirability of international agreement on scientific terminology. The needs may not be as pressing as in the political arena, but each added area of mutuality should be a step in the right direction.

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The Chemistry of the Steroids. Methuen's Monographs on Biochemical Subjects. W. KLYNE, M.A., D.Sc., Ph.D., Reader in Biochemistry University of London (Postgraduate Medical School). John Wiley and Sons, Inc., 440 Fifth Avenue, New York 16, N.Y. 1957. 216 pp. 12.5 × 19 cm. Price, $3.50.

One of the aims of this book is "to provide an outline of the chemistry of the steroids for the non-chemical readers... to enable him to discuss his problems with chemists better." This aim was not quite achieved for the truly non-chemical reader for he will find some parts of this book hard to follow. Some of this difficulty lies in the authors' use of chemical terms before they are explained.

The author "hoped that the book may also be useful to chemists whose special interest lies in another branch of the subject." Although there are a few elementary passages, this group will find this book valuable in obtaining a rapid introduction to steroid chemistry. Both groups will appreciate the difficulty in presenting the subject matter to two groups with different background.

The book opens with a brief but interesting chapter on the history of the steroids. The stereochemistry of the ring junctions and the various positions of the steroid molecule is discussed with a short description on the concept of conformation of ring systems. The most vital subject of nomenclature is clearly presented. The application of ultraviolet and infrared spectrometry and optical rotation on structure determination comprises the chapter on physical properties. There are two excellent chapters on the chemical properties of the functional groups on the steroids which will be particularly instructive to the non-chemical reader. The other chapters cover the naturally occurring steroids with brief discussions on the isolation and pertinent chemistry of the more important compounds. The basic methods of separation of the steroids are considered in the last chapter. Only an outline of the methods of determination of steroids is presented since this subject will be covered by a companion book.

This book is written in a very readable style and the text is amply supported with structural formulas and tables. There is a bibliography for each chapter. The references are principally to review articles which make further information on the subjects more accessible to the non-chemical reader. The book is recommended for both the non-chemical reader and the non-steroidal chemist who wish to obtain an introduction to steroid chemistry. It will also be a useful addition to the steroid chemists' library.

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Metallurgy of the Rarer Metals. General Editor of Series, H. M. FINNISTON, B.Sc., Ph.D., A.R.T.C., Head of Metallurgy Division, Atomic Energy Research Establishment, Harwell, Berkshire. No. 2. Zirconium. By G. L. MILLER, Ph.D., B.Sc., A.R.I.C., M.I.Chem.E., M.I.M.M. Academic Press Inc., 11 Fifth Avenue, New York 3, N. Y. 1957. xxi + 548 pp. 14.5 × 22 cm. Price, $12.50.

This second edition of Dr. Miller's book on zirconium cannot be regarded as a mere up-dating of the first edition issued 4 years ago, but rather as a new book which illustrates, by its 50% greater length and coverage of items not even mentioned in the first edition, both the exuberant growth of zirconium technology during the past 4 years as well as the expanded declassification policy of the USAEC. This volume, therefore, as the third and most recent major text on zirconium to appear within the past 4 years, must be reviewed within the present context of the existence of a voluminous literature as well as of a flourishing technology.

To condense this information within the confines even of this fairly bulky volume was indeed an ambitious undertaking; that many important facets of zirconium metallurgy are, as a result, inadequately reflected is of less consequence than the author's achievement of a critical and valuable collation of the data in several areas.

After two short introductory chapters devoted to occurrence and use of zirconium, the author discusses extraction from the ore and processes proposed for separation of zirconium and hafnium. It is unfortunate that the book was apparently sent to press late in 1956 and that hence the declassification of information on the Zr-Hf separation processes early in 1957 did not permit concentration on description of the processes commercially in use. The following three chapters admirably and critically review the reduction and refinement processes for metallic zirconium with respect to early developments in this field, present practice, and processes showing promise for future development. No better review of the present status of this subject can be recommended to the reader.

The physical properties of metallic zirconium are reviewed in a subsequent chapter which consists primarily of a listing of available data. The reader will find this section useful for reference but will gain from it an inadequate appreciation of the interesting physical metallurgy behavior of zirconium and its alloys.

The book continues with two lengthy but not very critical chapters on mechanical properties of zirconium and of zirconium alloys. The author, apparently by oversight, chose to include exactly the same curve (Figs. 76 and 92) in each chapter, and that curve of somewhat questionable significance in the first place. Little or no discrimination or emphasis is employed in discussion of the properties so that the reader not previously informed on this subject would have difficulty in separating information of value for application from that included merely for the sake of completeness. The effect of heat treatment on properties of zirconium is often more profound than that of the amount or nature of the alloying addition. In most cases the treatment prior to determination of properties is not specified so that only doubtful interpretation and use of the data are possible.

The following two chapters are devoted to the chemical properties of zirconium. Here again one gains the impression that the author has aimed at inclusiveness rather than discrimination and emphasis. For example there appears to be little value, in a book dated 1957, in devoting space to Fig. 123 showing pressure changes on heating zirconium powder in nitrogen without specification of particle size, heating rate, etc., particularly when data are available permitting quantitative calculation.

It was expected that the chapter on alloying behavior of zirconium would exhibit the high quality which one has come to expect of discussions of this topic in British metallurgical texts. In general the chapter confirmed these expectations. It is, however, incomplete in that the author, probably again by oversight, omitted mention of several systems on which information is readily available. For example, the systems of zirconium with indium, zinc, and cadmium are omitted even though each can be of considerable technological and metallurgical importance. A further point of criticism is the concealment of information on explosions noted during pickling of zirconium-uranium alloys, which has been a major subject of concern, in the discussion of the zirconium-uranium binary system, with no index reference to it that the reviewer was able to find.

The chapter on melting practices impressed the reviewer as being complete, critical, and authoritative, and is again recommended to the reader as the best exposition available in this field. On the other hand, even though zirconium production has expanded ten-fold during the past four years and its fabrication has, during this period, made the transition from largely government-operated facilities to commercial fabrication, the author chose to devote no more space to this subject than he did in his first edition. In fact, the subsequent chapter on powder metallurgy of zirconium occupies almost as much space as that devoted to all other fabrication, joining, and surface finishing practices even though no significant quantity of material is presently fabricated by the former technique. The reader is cautioned therefore that the state of the art as of 1957 is by no means adequately represented in the fabrication chapter. The author concludes with an interesting discussion of zirconium compounds and an appendix on metallography of zirconium. The reviewer believes that the discussion of metallography could have been considerably improved by including suitable micrographs, and was surprised to note that the entire text was issued without a single illustration of a typical microstructure.

The particular interests of the author in metal reduction and melting undoubtedly account for the high quality of the sections devoted to these topics; it is regrettable that the reviewer cannot equally commend his coverage of other fields. It was well known in 1957 that practically all the commercial production of zirconium was devoted to nuclear applications, particularly those involving exposure to high temperature water. Yet, the author appears reluctant to associate his subject with nuclear energy. This is exemplified in his discussion of uses of zirconium in which he devotes almost as much space to neurosurgical applications, which will furnish an outlet for a few ounces of zirconium per year, as to nuclear applications, and far less than is devoted to electronic applications utilizing pounds rather than tons of zirconium. This attitude has a much more serious effect with respect to the author's discussion of radiation effects on zirconium. Here he confines his discussion to four references, one of which can be seriously misleading to the reader unless properly interpreted. Even these references were improperly abstracted in that the flux exposure was quoted in terms of thermal flux, which probably has little or no pertinence to property changes, rather than in terms of fast flux. This lack of appreciation of the problems arising during application appears to have led, for example, to complete omission of information on the technologically highly important fatigue properties; to omission of data on hydrogen pickup during processing and operation, and on control of hydrogen content; to an inadequate discussion of the mechanical property effects of hydrogen; to no consideration of the hazards and problems in use of zirconium in hot water systems; to lack of mention of the principal application of zirconium in fuel elements, much less of fabrication techniques such as roll bonding; to scattered and incomplete reference to the major commercial alloy of zirconium, Zircaloy-2, and no reference to its modifications; to failure to discuss the problems of surface finishing and pickling which are of such commercial concern and the effects of melting practice on weldability, corrosion resistance, etc. Many additional omissions could be added to this list.

In summary, then, Dr. Miller is considered to have made a substantial contribution to the literature on reduction and refining of zirconium metal and its subsequent melting; those interested in the physical metallurgy, fabrication, and subsequent application of zirconium will find this book interesting and helpful, but will find it advisable to supplement the information by extensive reference to other literature.

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Free Radicals in Solution. CHEVES WALLING, Professor of Chemistry, Columbia University. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1957. xii + 631 pp. 15.5 × 23.5 cm. Price, $14.50.

After reading this book I was compelled to look again at two earlier works on Free Radical Chemistry, namely, "The Aliphatic Free Radicals" by F. O. Rice and K. K. Rice, and "The Chemistry of Free Radicals" by W. A. Waters. Doing this gave one the proper perspective against which to assess the present volume. It also brought home very forcibly how tremendous have been the advances in the chemistry of free radicals in the past few decades. That Professor Walling has been able to give such a very lucid, learned, and detailed account of this enormous branch of chemistry is nothing short of amazing.

Professor Walling introduces his subject with a chapter on The Structure and Physical Properties of Free Radicals. In this he discusses the evidence for the existence of free radicals and includes a brief account of the recent paramagnetic resonance work. This chapter is followed by a very good one in the Chemical Reactions of Radicals in which the various types of free radical reactions are discussed. The latter part of this chapter is taken up with an excellent account of Bond Dissociation Energies. Then Professor