BOOK REVIEWS

Metallurgy of the Rarer Metals. No. 6. Tantalum and Niobium. By G. L. Miller, Ph.D., B.Sc., A.R.I.C., M.I. Chem. E. M.I.M.M. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. xxii + 767 pp. 15 × 22 cm. Price $21.00.

This is the first full size comprehensive book to be devoted entirely to tantalum and niobium and because of the important positions of these metals in the field of high temperature technology its publication is indeed timely.

Dr. Miller's treatment of the subject is thorough and the book is written with the authority which is justified by the author's intimate experience with these and the other refractory metals. The text is well organized in twelve chapters and embraces a 14 page table of contents which is carefully indexed to simplify the location of specific subjects. Innumerable reviews or condensations of original articles are found throughout the text and the bibliographies are in themselves an important contribution to the subject. The volume presents a blend of historical, theoretical and practical material and brings the reader up to date on the properties, production methods, uses, etc., of tantalum and niobium.

The first eight chapters, 345 pages, cover the early history of these elements, the sources of their minerals, the metallurgical extraction and reduction of the metals and their fabrication into useful shapes. Methods of extraction, of reduction, consolidation and fabrication are very thoroughly explored and include classical as well as current processes.

Almost two hundred pages are devoted to the properties of the metals and include a great many tables, charts and condensations of articles which have contributed to this knowledge. The corrosion resistance of the metals and particularly their reactions with gases are very thoroughly reported in this section.

The beginning of the space age started a soaring interest by metallurgists in metals with good high temperature strength. It is not surprising then to find that Dr. Miller used more than one hundred pages to discuss the binary alloys of tantalum and niobium. He cites 154 references on this subject.

The final chapter of the book is a study of certain compounds of tantalum and niobium, particularly the nitrides, carbides, borides and silicides. All of these compounds are hard metallic materials but only the carbides are of current commercial importance.

Appendices include information on the analytical chemistry and the metallography of the metals.

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Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Silicium. Teil B. System-Nummer 15. E. H. Erich Pietsch, Editor. Verlag Chemie, G.m.b.H., (17a) Weinheim/Bergstr., Pappelallee 3, Germany. 1959. lix + 923 pp. 17.5 × 25.5 cm. Price, Kart. DM. 570.--; Geb. DM. 575.--.

This companion volume to Teil C on organosilicon compounds (This Journal, **82**, 2405 (1960)) represents a monumental effort on the part of the unique Gmelin Institute in Frankfurt. Eighteen co-workers labored with Editor Pietsch for ten years to collect and organize *all* of the information in the chemical literature on silicon, which is by no means a recent or rare or poorly-understood element The result is a magnificently organized book of about a thousand pages, with a 59-page Table of Contents (in both German and English) listing 3068 items. It covers all of the chemical and physical properties of elementary silicon and its inorganic compounds except the silicate minerals.

One reason why Teil B is so large is that this ancient element has itself come in for a great deal of study. It requires 23 pages just to summarize the electrical properties of silicon, and of course many more to cover the preparation and purification, the nuclear and magnetic properties, the ionic radii and crystallographic constants, the mechanical, thermal and optical properties, and of course the chemical behavior and methods of analysis.

As for the sections on compounds, your reviewer believes that here is to be found the best review of the hydrides of silicon (30 pages long) available today, and this subject has come a long way since Stock's book of 1933. It is no surprise that SiO_2 comes in for 139 pages of description, there being so much known about the electrical, mechanical, petrographic and chemical properties of all its variations. The silicic acids and the hydrosols and gels of silica come in for even more treatment, however, 174 pages of it. Properties of the carbide take up 95 pages, and the halides 132. While the silicate glasses themselves are not covered, being relegated to the ceramic chemistry of silicon, 56 pages are devoted to the construction and behavior of the glass electrode, and this, too, is a review unobtainable elsewhere.

Just to note a few oddities that come to light as one goes through the book, anyone who wants to determine silicon in cosmetics or apples, or wants to analyze for silicon by activation with fast neutrons, or seeks to know the ionic radius of Si^{+4} under all conditions (it varies to an astonishing degree, from 0.22 Å. in highly polarized compounds to 1.82 Å. in Mg_2Si), or wants to know the action of $SiCl_4$ on Be or the Raman spectrum of $Si_4O_3Cl_{10}$, will find his answer here. The Gmelin Handbuch tells not just where to find facts, but lists, relates, and appraises the facts. This is why it is invaluable, and always will be so as long as chemists have limited lives and patience.

Some will object that the Gmelin volumes are always out of date. This, of course, is inevitable, since the series is not a mechanical listing of facts but a sober appraisal and reorganization of the information. In the present case the objection is met in part by a supplementary listing of the pertinent literature from 1950 to 1959, covering the period of preparation of the volume. Others may remark that the whole business is a fantastic rear-guard action, that the Gmelin Institute cannot hope to keep up with a chemical literature that doubles every 14 or 15 years. Well, if anyone can, the Gmelin people will, and they certainly act as though they intend to keep right on doing it.

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Oxidation-Reduction Potentials of Organic Systems. By W. Mansfield Clark, Ph.D., Sc.D., DeLamar Professor Emeritus of Physiological Chemistry and Research Professor of Chemistry, The Johns Hopkins University. The Williams and Wilkins Company, Baltimore 2, Maryland. 1960. xi + 584 pp. 16 × 23.5 cm. Price, $13.50.

Into this highly readable book Professor Clark has distilled the essence of nearly a half-century's pioneering research experience on potential measurements of electric cells. He has very successfully met his stated goal of providing in one volume both a theoretical and experimental introduction to this rather specialized technique for interested research workers and students in all fields of Chemistry and Biology. The work is restricted, as not indicated in the title, to a consideration of oxidation–reduction potentials of organic systems which are or can be made electromotively active and measured under equilibrium conditions in an electric cell. The technique is thus, presently at least, of somewhat limited value to organic chemistry, but gives more promise of increasing application to biochemical systems.

An introductory historical chapter is followed by one which reviews those elements of thermodynamics which are essential to an understanding of reversible electrode processes. Chapter III discusses "Conventions and Definitions of Some Special Terms." These are in accord with the modern trend toward the "European" sign convention. Particularly notable are the economy of formality and the phenomenological approach. Subsequent chapters explain the effects of such factors as *p*H and the formation of dimers, intermediate free radicals or coördination compounds on the shape of the curves relating percentage oxidation of a reaction system to its oxidation–reduction potential. Graphical methods for obtaining the various ionization or equilibrium constants which in special cases may be superimposed on the measured oxidation–reduction equilibria are enumerated. Statistical treatment of data, now made practical by the wide availability of electronic computers, is not included. A chapter is devoted to the detailed consideration of the problem of electrochemical and especially *p*H standards. Experimental techniques, mainly of the classical variety, are considered in some detail in a valuable separate chapter. Polarography, considered outside the scope of the present work, is only briefly discussed in a single chapter with other miscellaneous topics. The final part of the work consists of about one hundred and sixty pages devoted to compilations of oxidation–reduction potential data for various different organic systems. There is included an extensive bibliography and an index which seems quite complete. The book is attractively made and quite free from mechanical errors.

The outstanding characteristics of the work are the author's historical perspective, his authoritative but easy style, his careful critical sense and his close integration of the theoretical and experimental aspects of his subject. Neglected are some of the more modern developments such as the work of Delahay and others on kinetic complications in electrode processes and Gerischer's work on exchange currents.

Electrochemical specialists will value this volume chiefly for its historical perspective and pedogogical worth. For any non-specialist or student interested in making and/or interpreting electrode potential measurements of organic systems it will be indispensable.

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Modern Coördination Chemistry. Principles and Methods. Edited by J. LEWIS, Department of Chemistry, University College, London, and R. G. WILKINS, Department of Chemistry, University of Sheffield. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, New York. 1960. xvi + 487 pp. 16 × 23.5 cm. Price, $12.50.

Interest in the chemistry of coördination compounds has grown tremendously within the last few years, and, seemingly, is still increasingly at a logarithmic rate. In the United States and Britain, at least, this was probably triggered by the demands of war-time research, but other factors have also been important. Among these, one might mention the general increase in interest in inorganic chemistry, the development of physical research methods, and the commercial availability of precision instruments for physical measurements. One must mention also the stimulating effect of bold theorizing by Pauling, the Bjerrum's and others, and the beautiful experimental work of Morgan, Sidgwick, Mann, Burrows, and numerous other pioneers in the upsurge of interest in this field. Improvements in experimental methods have led to modifications of the classical coördination theory, and it is now recognized that the metal–ligand bond is, in reality, several kinds of bonds. The realization of this multiplicity has greatly stimulated further research in the chemistry of complexes and has opened vistas which were not even imagined a decade ago.

As was to be expected, the rapid growth in the number of research publications on coördination compounds has stimulated the appearance of several books dealing with various aspects of the chemistry of these compounds. Interestingly enough, each of these has been quite different from the others, and each has filled a real need. The most recent of them," Modern Coördination Chemistry," is no exception. It might equally well have been titled "Physical Coördination Chemistry," for in it the authors have discussed the physical principles underlying the behavior of coördination compounds and the major physical techniques which are used in investigating them. Experimental methods are described in good detail, and then the interpretation of the results. Each of the six chapters is written by an author (or authors) who can speak with authority based upon his own research experience in the field in question. All of the authors write lucidly and critically, with interesting comments on the research which they are reporting, and with extensive documentation. The book contains more than 1400 references, roughly ninety per cent. of which are taken from the literature of the last decade. The authors have succeeded admirably in their dual goal of writing so that any experienced chemist can read with understanding, and so that experts in the field will find the book valuable as a reference and review. All will find it richly rewarding.

Nothing more need be said other than to list the authors and the chapter titles, which will show the scope of the book: The Thermodynamics of Metal Ion Complex Formation in Solution (F. J. C. Rossotti); The Reaction Rates of Transitional Metal Complexes (D. R. Stranks); The Isomerism of Complex Compounds (R. G. Wilkins and M. J. G. Williams); The Visible and Ultra-Violet Spectra of Complex Compounds (T. M. Dunn); The Infrared Spectra of Transitional Metal Complexes (F. A. Cotton); The Magneto-Chemistry of Complex Compounds (B. N. Figgis and J. Lewis).

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