analyst and by the individual researcher," requires thoughtful consideration.

No radiochemical analyst and, shortly, no analytical chemist, can afford to disregard the material included in these volumes, and the incalculable impact that radiochemical analysis will undoubtedly have on the future of analytical chemistry.

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About the Reviewer: Dr. Paul Kirk is presently at the University of California at Berkeley, School of Criminology. He took his AB at Ohio State in 1924, his MS at Pittsburgh, 1925, and his PhD in Biochemistry in 1927 at the University of California. He has been a professor at the University since 1945. His interests include micrometallurgy of plutonium, protein chemistry, analytical toxicology, quantitative and criminological analysis.

Energetics in Metallurgical Phenomena—Volume 1. Edited by William M. Mueller. Published by Gordon and Breach Publishers, New York (1965). 440 pp., $19.50.

The articles in this book are based on part of the proceedings of the extended 1962 Seminar on Energetics in Metallurgical Phenomena, held at the University of Denver. There are eight separate articles contained in the book, each covering a different phase of energetics in metallurgical processes of current interest. A list of the topics and authors are: Intermetallic Diffusion by David Lazarus, Solid Solutions by Rudolf Speiser, Nucleation Processes by Michael Bever, Transformations by Earl Roberts, Metastable Phases Obtained by Rapid Solidification by Pol Duwez, Annealing Mechanisms in Deformed Metals by Paul Gordon, Energetics in Dislocation Mechanics by John Dorn, and Oxidation of Metals by Kenneth Lawless. A more complete list of vital current subjects could scarcely be compiled. Each article is preceeded by a detailed table of contents and the volume itself contains a complete subject and author index.

In almost every case the authors have presented a comprehensive review of basic theory and current developments in their particular field. In fact, one has the impression that the articles themselves represent a compilation of lecture notes for a course of the same title. The general level of these articles is that of a graduate course in metallurgy or physics. The material is presented first in basic terms and is then developed up to the present state of knowledge, or at least as of 1962. Thus, the general reader is bound to learn something from each article and can progress in his reading according to the level of his interest and background.

While the quality of writing is uniformly good throughout, the sections of Diffusion, Nucleation, Annealing, and Dislocation Mechanics are particularly instructive and complete. For example, Dorn's treatment of dislocation theory runs over 100 pages. It is comprehensive and quantitative where necessary.

Unfortunately, it must be realized that in some of the more rapidly developing topics covered, such as transformations, dislocation theory, and metastable phases, the articles are four years behind the most current developments. This delay seems to be one of the attendent evils in publishing the proceedings of seminars and meetings.

In conclusion, this book is recommended for students and researchers in physical metallurgy and related disciplines. The reader will find under one cover not only a detailed review of his own field of endeavor complete with detailed references, but also a comprehensive treatment of virtually all the most vital topics in the fast-moving field of energetics. To quote from Editor Mueller, "It would be unfortunate if only those who were able to attend the seminar were to derive benefit from this material."

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About the Reviewer: S. Bradford McRickard has been associated with the Metallurgy Division of Brookhaven National Laboratory since 1959. Prior to that he was a metallurgist at Westinghouse's Bettis Atomic Power Division where he was concerned with radiation damage studies of fuel alloys.

At Brookhaven he has been studying the mechanical properties of body-centered cubic metals and the effects of irradiation on these properties. He has published a number of papers on the effects of temperature, composition, and irradiation on the properties of pure iron and steel.

He obtained his BS in Metallurgical Engineering from New York University and MS from the Polytechnic Institute of Brooklyn.

Refractory Transition Metal Compounds; High-Temperature Cermets. G. V. Samsonov, editor. Translation by Scripta-Technica, Inc. Translation Editors: G. E. Gurr and D. J. Parker. Academic Press, New York (1964). 220 pages, $9.00.

This book consists of a collection of papers edited by the eminent G. V. Samsonov. In this volume he has assembled a series of papers presented at a Seminar on Physical Properties and Electron Structure of Compounds of Transition Metals, held at the Institute of Cermets and Special Alloys of the Academy of Sciences of the Ukrainian SSR. He has included, in addition, papers summarizing extensive investigations carried out in recent years (generally to 1962) at various technical institutes and universities throughout the USSR. This collection is a broad review of theoretical and experimental studies indicating the "state-of-the-art" of Soviet research into the nature and properties of the refractory transition-metal compounds.

The nature of the physical properties of refractory compounds and the basic laws relating the variations of these properties with changes in crystal and electron structure are of vital importance to the physicist and materials scientist. Knowledge of the fundamental properties of these compounds, in turn, facilitates solution of the problem of producing new refractory materials with specific, well-defined properties. These papers represent significant contributions to our knowledge of transition-metal compounds by a number of Soviet researchers.

Four of the papers are primarily theoretical. These include a paper by Samsonov reviewing his approach to

classification of transition-metal compounds according to the scheme he proposed in 1953. In this well-known approach, based on the acceptor-donor relationship between transition-metal and non-metal additives, he relates the electron-dependent properties of these phases to principal quantum number, number of electrons in unfilled "*d*" shells, and ionization potentials of the non-metals. Despite its qualitative nature, the approach correlates with experimental data and has successfully predicted properties of refractory nitrides, carbides, and borides. A short paper by Shulishova presents a method of calculating crystal lattice energy for inorganic compounds. Another short paper is devoted to a quantum mechanical derivation of an approximate expression for residual resistivity of alloys composed of a transition and a non-transition metal. Dudkin presents an extensive study of the nature of metallic and semiconductive properties of transition-metal compounds. He proposes criteria for predicting the formation of semiconducting phases in these systems from crystal-chemical analysis and knowledge of the electronic structure of the transition-metal component. Successful application of the criteria to compounds of several structure types is demonstrated.

• The remaining 15 papers in the collection present results of various experimental studies on a number of transition-metal compounds. Thirteen of these papers deal with physical property measurements and interpretation of the results in terms of crystal and electronic structures. Four papers discuss x-ray emission and absorption spectra for transition metals and the changes that occur in the spectra as a result of compound formation. Individual papers are devoted to absorption spectra of compounds of chromium with carbon, silicon, and germanium; *L*-series spectra in refractory niobium compounds; impurity effects on *L*-series spectra in refractory niobium compounds; impurity effects on *L*-series emission spectra of germanium; and an excellent, extensive review paper by Nesphor on interatomic bonding in carbides, nitrides, borides, and silicides of the transition metals as deduced from x-ray spectral analysis. Other papers discuss such topics as electromigration of components in iron-base alloys; electrical properties of rare-earth hexaborides, molybdenum silicides, and the highly refractory carbides and borides of the transition elements of groups IV to VI; and, finally, thermionic emission properties of scandium and gadolinium borides. Three papers are devoted to structural analyses of crystal phases in the Fe-Si system and measurement of their electrical properties.

Two papers are outside the general theme of the book. One is devoted to preparation of lanthanum hexaboride and the second is a summary of intermetallic compounds crystallizing with the β-uranium structure. With these exceptions, the central unifying theme of the series is preserved.

In general, the papers are well written, though in some cases somewhat succinct, perhaps because of their "progress report" nature. In several papers there are few references and in one case, none at all (even though the author refers to pertinent work by a number of other authors in his text).

The English translation reads smoothly. The editors have thoughtfully included a subject index, a useful item often neglected in a book of this type.

The collection, then, is a valuable summary of contributions by a number of Russian scientists to the understanding of refractory transition-metal compounds. It should be a worthwhile addition to the library of the researcher concerned with fundamental studies on materials for advanced high-temperature applications.

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About the Reviewer: The reviewer has been associated with the Nuclear Materials and Propulsion Operation of the General Electric Company since 1957 and presently is a Principal Engineer in the Special Ceramic Materials Research Unit specializing in measurement of the physio-chemical properties of refractory transition-metal compounds for advanced high-temperature applications. His experience has included evaluation of high temperature properties of refractory oxides and intermetallic compounds. Mr. Juenke received his academic training in physics at Xavier University and at St. Louis University.

Effects of Radiation on Semiconductors. By Victor Sergeevich Vavilov, Consultant Bureau, (1965). 225 pages, $25.00.

To English-speaking readers for whom the term "radiation effects" has a special connotation, the title of Vavilov's book can be quite misleading. Reinforced by the fact that the author is perhaps the leading Soviet exponent of radiation damage in semiconductors, it is quite natural to assume that the English usage applies, and that the entire volume is concerned with permanent effects produced by exposure of semiconductors to energetic radiation. Such is not the case. Of the book's five chapters, only the last one deals with the problem of the influence of radiation-induced defects on semiconducting behavior; this amounts to less than a third of the volume.

The first four chapters treat primarily photoelectric phenomena, and ionization processes due to high-energy charged particles. Chapter I concerns absorption of photons by semiconductors and the physical processes that dominate optical absorption in the various spectral ranges (intrinsic or fundamental absorption, adsorption by localized states of imperfections, free carrier absorption, and the excitation of lattice vibrations by photons). Also discussed are the effects of external parameters (pressure, temperature, and magnetic fields) on the various absorption processes. Chapter II treats photoconductivity due to both photo-ionization of localized states and band-gap excitation. Also included is a rather sketchy treatment of the recombination and trapping kinetics of photocarriers. A brief discussion of photo-intensity effects and other complicating factors is added to the end of the chapter.

Interaction of high-energy charged particles with semiconductors forms the topic of the third chapter with the primary emphasis on ionization processes. The main import here is a discussion of the experimental and theoretical aspects of the yield of electron-hole pairs created by the high-energy charged particles, i.e., the energy consumed per electron-hole pair produced for a variety of semiconductors. Unfortunately, the author did not discuss the very important application of this research to nuclear particle spectrometry through the use of semiconductor-junction particle detectors, and the very interesting problems associated therewith. Chapter IV