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Book Reviews

Radiochemical Methods of Analysis. Published by International Atomic Energy Agency, Vienna, 1965. Distributed by National Agency for International Publications, Inc., 317 East 34th Street, New York, N. Y. 10016. Vol. I, 433 pp., $9.00 (May 1965). Vol. II, 522 pp., $11.00 (June 1965).

This two-volume publication includes two lectures, and 62 papers presented at a symposium in Salzburg, Austria, in October 1964. It covers all types of radiochemical techniques applied to the analysis of many kinds of materials. It certainly provides the most comprehensive survey of the present status of radiochemical analysis that is currently available.

A major development that can revolutionize a science happens only at long intervals. The use of radionuclides as analytical tools is one such development, because it represents an approach almost independent of chemistry on the one hand, and of conventional chemical instrumental methods on the other. Overlap with x-ray techniques and the use of chemical separations to isolate radioactive isotopes from interference are the chief points of contact with conventional analytical methods. This freedom from the burdensome and often indecisive aspects of the standard chemical techniques has led to most enthusiastic advocacy of various radiochemical approaches. The vigorous discussions that follow most of the papers are both exceptional and illuminating. It is clear that much more investigation will be required to allow the degree of standardization in choice of method that has long characterized conventional analytical chemistry. On the other hand, the ultimate contribution of radiochemistry is confidently expected not only to supplement, but to augment our ability to understand chemical systems to a degree that is probably not presently conceivable.

Volume I begins, logically, with two informative and interesting lectures (one by G. de Hevesy, the other by W. W. Meinke) which orient the reader historically, and with respect to trends in the future development of the total field. The remainder of this volume is devoted exclusively to consideration of radioactivation analysis, the material being broken into three sections: 1) reactor activation analysis (16 papers); 2) use of radioactive sources (4 papers); and 3) use of accelerators (7 papers). Volume II continues with radioactivation analysis in two sections: 1) experimental techniques (10 papers); and 2) application of computers to activation analysis (5 papers). It also includes discussion of analytical applications of radioactive tracers in three sections: 1) use of radioactive reagents, indicators, and precipitants (5 papers); 2) use of radiochemical release reactions (2 papers); and 3) isotope dilution analysis (6 papers). The book concludes with discussion of analytical applications of radioactive sources in two sections: 1) absorption and scattering of radiation (1 paper); and 2) emission of secondary radiation (6 papers).

As would be expected, the majority of the concern was with the use of activation analysis, which has been applied in many ways and to a wide variety of sample types. Predictably, a majority of the papers concern the analysis of such conventional materials as minerals, metals, reactor materials, and chemical mixtures. However, biological fluids were analyzed for iodine, cobalt, chromium, vitamin B-12, aldosterone, and amino acids. The age of paintings and the sources of ancient Greek marbles was determined. Human hair, snake venoms, meteorites, and lubricating oil underwent analysis, and the thickness of coatings of textile fibers was determined by a radiochemical method. Most of these uncommon analyses were made by neutron activation analysis, some by isotope dilution methods.

These volumes contain a wealth of technical material. Some of the high points of new or modified techniques, and considerations of alternative methods, include the following: boron analysis in steel by depression of activation; several papers describing portable equipment relying on bremsstrahlung, e.g., from $^{3}H/Zr$, or on photons from $^{241}Am/Cs$, or 122-keV gamma rays from ^{57}Co; at least three new designs for anticoincidence shielding in gamma-ray spectrometry, with major reduction also of Compton distribution; small and portable sources of fast and thermal neutrons, including an inexpensive gaseous source based on ^{18}O; neutron absorption measurements; and photoneutron counting for high-energy gamma rays > 1.67 MeV for Be, and > 2.23 MeV for D used for neutron generation. Two papers considered the problems of activation at very high neutron flux, e.g., in a pulsed reactor. Differences of opinion were discussed in detail between five alternative methods for analysis of oxygen, using $^{18}O(p,n)^{18}F$, delayed neutrons of ^{17}N, $^{16}O(^{3}He,p)^{18}F$, $^{18}O(\alpha,n)^{21}Ne$, or gamma-ray activation at 28 MeV maximum with an accelerator. Five papers considered computer program development, and some attention was given to automated equipment. Only one paper was devoted to artifacts and errors—a possible deficiency of the symposium.

It is only fair to mention that *sampling*, one of the most serious difficulties of the conventional analytical chemist, appears to this reviewer to be even more serious to the radiochemical analyst. Little attention was given to this problem, except as a minor and specific matter. The statement included in the Meinke abstract, "The methods of radiochemistry will be most significant for the future when they no longer are the sole responsibility of radioactivity specialists in reactor centers or in industrial laboratories but instead are freely utilized by the practicing

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