KEEPING UP WITH A FAST-MOVING TECHNOLOGY

Title Materials Science Research, Vol. 2

Editors H. W. Otte and S. R. Locke

Publisher Plenum Press, 1965

Pages xiv + 319

Price $13.50

Reviewer Stan J. Paprocki

This book is a compilation of papers presented at the 1964 Southern Metals/Materials Conference on Advances in Aerospace Materials, held April 16 and 17, 1964, at Orlando, Florida. All the papers are of excellent quality reflecting a well-planned and -organized conference.

The purpose of the conference was "to identify materials processes and methods that show the greatest potential in future space technology and to define the gap between mission requirements and materials applications". A review of the papers reveals that this objective has been fulfilled. The collection is presented in two parts: One part includes papers concerned with fundamental problems, and the other covers those related to applied research. Although there is no direct literary bridge between the fundamental and applied papers, they are more than usually complementary in subject matter.

Part I of the book is concerned with some of the more important fundamental factors that influence material properties. The relationship of grain boundaries to properties of ceramic materials, the characterization of defect structures and their influence on oxide materials, the effects of irradiation on molybdenum, and the role of dislocations in deformed beryllium are some of the timely subjects covered.

In Part II, some of the more advanced applied research work on materials is presented. All subject matter is of current importance and will be required reading for anyone interested in keeping abreast of this fast-moving technology. The papers cover such subjects as ductile chromium, formable sandwich structures, arc-cast tungsten, graphite-base refractory composites, glass microtape, and lightweight aerospace materials.

In summary, this second volume of *Materials Science Research* must be counted as one of the better editions of books that embody a series of papers presented at a technical conference. Full credit should go to its editors, who also were involved in organizing the technical program of the conference. The book is recommended for both engineers and scientists who have a strong interest in materials science and research.

Stan J. Paprocki is a Manager of the Materials Engineering Department at Battelle Memorial Institute, Columbus, Ohio. For the past 15 years he has been concerned with materials problems related to nuclear technology. Currently he is the Vice-Chairman of the Materials Science and Technology Division of the American Nuclear Society. His BS and MS degrees are in metallurgical engineering from the University of Illinois.

Ed. note: For a variety of reasons, it is not the policy of **Nuclear Applications** *to review a book that comprises the collected papers of a symposium, although we may announce such books, depending on the subject matter. Occasionally, when the collected papers result in a well-rounded book of unusual merit or of particular interest to our readers, we make an exception to this policy.*

THE MOST COMPREHENSIVE WORK ON SCINTILLATORS...

Title The Theory and Practice of Scintillation Counting

Author J. B. Birks

Publisher Pergamon Press, Inc., 1964

Pages xx + 663

Price $17.50

Reviewer R. B. Murray

The first use of the scintillation counter in its present form (a scintillator optically coupled to a sensitive photomultiplier tube) occurred in the late 1940's. A few years later, in 1953, a monograph of some 150 pages *(Scintillation Counters)* was published by J. B. Birks; it gives a fairly comprehensive review of the properties of scintillating materials known at that time and their applications to nuclear counting and spectroscopy. The explosive growth in the development and applications of scintillation counters in the last decade is reflected in the size and scope of the present treatise. This volume represents a thorough and encyclopedic treatment of the mechanism of the scintillation process in various media and the applications of the scintillation method to diverse problems of radiation detection and spectroscopy. This book stands as the most comprehensive work available on the subject of scintillators and their uses, and it is likely to remain so for some time.

As indicated in the title, the contents of the book can be divided into two principal categories: (a) the interactions of radiation with scintillation media and the ensuing processes, which result in the emission of a scintillation pulse, and (b) the technical and instrumental aspects of the use of scintillation counters for specific applications. Under category (a), four chapters (about one-fourth of the book) are devoted to the fundamental

mechanism of the scintillation process in organic materials (crystals, liquids, and plastics) and in inorganic crystals, particularly the alkali halides. Detailed consideration is given to those features of the scintillation process (in organics) that lead to a dependence of the scintillation efficiency on dE/dx of the exciting particle (ionization quenching). The origin of the "slow" scintillation component in organic crystals is discussed in some detail, and several alternative theories are summarized. The treatment of the scintillation process in alkali halides is focused largely on effects responsible for the dependence of scintillation efficiency on ionization density. The experimental and theoretical situation is reviewed thoroughly, and Birks discusses the close analogy between the behavior of alkali halides and that of organic crystals.

Category (b), the "practice" of scintillation counting, accounts for most of the material in the book. The detection of scintillation events is treated in a chapter that considers the problems of light guides, photomultiplier spectral response functions, electron multiplication, the energy resolution of scintillators, and time resolution. Included is a comprehensive table giving the characteristics of almost 100 different photomultiplier tubes available from U S and European manufacturers. The various sources of line broadening in gamma-ray and charged-particle spectroscopy are considered, and the author gives a valuable critique on the effects responsible for the gamma-ray line width in NaI(Tl). Four chapters are devoted to the properties and applications of various organic crystals, liquids, and plastics, with liberal documentation in the form of tables and graphs. Gamma-ray spectroscopy with NaI(Tl) is treated in detail. Electronic instrumentation which follows the scintillation counter (i.e. from pre-amp to multi-channel analyzer) is not considered in this book.

In summary, this volume will undoubtedly serve as a standard reference and source book for those engaged in the development or uses of the scintillation method. Fortunately, the delay between writing and publication has been minimized; references to the 1963 literature are included. Although it is not directed primarily to students, the book is written in a lucid manner permitting the nonspecialist to read, profitably, sections of interest to him. It might also be noted that the study of the scintillation process per se provides a valuable insight into many aspects of the interaction of radiations with matter and the subsequent transfer and dissipation of energy. Birk's book should, therefore, prove to be of considerable value to those interested in the general subjects of radiation physics and chemistry.

R. B. Murray received the PhD degree in physics from the University of Tennessee while he was a Pre-Doctoral Fellow at Oak Ridge National Laboratory. He has been a member of the research staff at ORNL since then, with the exception of one academic year spent as Visiting Associate Professor at the University of Delaware. His research activities have included studies of the scintillation process in activated alkali halides and, currently, the relation between color centers and luminescence in alkali iodides at low temperature.

... AND THE MOST COMPREHENSIVE WORK ON THERMAL CONDUCTIVITY OF REAL GASES AND LIQUIDS

Title Thermal Conductivity of Gases and Liquids

Author N. V. Tsederberg

Translator Scripta Technica (Russian to English); Robert D. Cess, editor

Publisher The MIT Press, 1965

Pages xiv + 246

Price $12.50

Reviewer John C. Chen

This is an English-language version of a monograph originally published in the Soviet Union. To the best of my knowledge, it is the most comprehensive work devoted to the thermal conductivity of real gases and liquids currently available. Literature in this field dates back almost a hundred years, and a book that seeks to review critically all the scattered publications, to examine the various theories, and to compare experimental results should be welcomed by any worker in the field.

The author maintains a good balance between the idealized ramifications of theory and the practicalities of experimentation. Thus, the first chapter discusses basic experimental methods for measurement of thermal conductivities, while the second chapter reviews the major theories for calculating thermal conductivities. The inherent uncertainties of each are discussed, and then theoretical and experimental results are compared. This same approach is taken throughout the book.

Subjects discussed include calculation of gaseous thermal conductivities from kinetic theory, temperature dependence of thermal conductivities for gases at near atmospheric pressures, and thermal conductivities of gases under high pressures, of liquids at both atmospheric and high pressures, of gaseous or liquid mixtures, and of gaseous plasmas. The discussions on conductivities of mixtures deal with mixtures of both reactive and inert gases and with both nonionic and electrolytic solutions.

References are well documented. The book presents a total of 336 references, of which approximately half are from Russian sources. This rather complete and up-to-date summary of Russian work would in itself be of interest to many research workers in the English-speaking countries.

To me, one of the most valuable aspects of this book is its many tables that compare and intercompare calculated and experimental results. Such tabulations will be useful to anyone interested in checking his own measurements with other similar results or in determining the validity of using a correlation in any specific circumstance. As an example, a table in the chapter on conductivities of liquid solutions compared experimental values to those obtained by application of the additive