because of its importance in the disposal of radioactive wastes in the ground. But the main reason for the recent resurgence of interest in inorganic ion-exchange materials is their greater resistance to high temperature and ionizing radiation compared with their organic counterparts. These features make them suitable for such applications as the treatment of radioactive waste liquids and the deionization of the hot water in the cooling loops of pressurized-water reactors.

To meet the growing need for information excited by these new applications, C. B. Amphlett, a distinguished scientist and a world-renowned authority on ion exchange, has summarized in his monograph *Inorganic Ion Exchangers* most of what is known about these materials. He has divided his book into five chapters. The first is a short introductory chapter containing a brief historical sketch of ion exchange and a short discussion of a miscellany of inorganic exchangers. The remaining four chapters are devoted to the four main classesof inorganic ion-exchange materials: the clay minerals; the zeolites; the heteropolyacid salts; and the hydrous oxides, zirconium phosphate, and related materials. The discussions of each of these classes follow the same general pattern with minor variations according to the special properties of the particular exchanger being discussed (e.g. the ionic sieve action of the zeolites or the swelling of some of the clay minerals). The discussion begins with consideration of the relation of structure to ion-exchange behavior. Following that there is a discussion of ion-exchange equilibria with particular attention being paid to the existence of well-defined affinity series. Many exchange isotherms are shown and analyzed for thermodynamic data, and the book contains several tables of equilibrium constants, free energies and heats of exchange. Some of the isotherms also show peculiarities which are related to structural features of the exchanger, e.g. the isotherms of the thallous-sodium, thallous-silver, and silver-sodium exchange on Linde Sieve 4A. Finally, there is usually a short discussion of the kinetics of exchange.

According to the author, the book is intended not as an exhaustive survey of inorganic ion exchangers but rather "as a guide to the present state of the subject." As a guide it is outstanding, conveying, as it does, the basic facts about inorganic ion exchangers in a well-organized and easily understood manner.

To me a scientific book is a tool, and to be a good one it must be easy to use. Ease of use in a book is determined by the presence of such things as an extensive index, a descriptive table of contents, complete references, clearly drawn and labeled figures, and useful and informative tables. Amphlett's book is more than satisfactory in all these regards. Two additional features that make the book easy to read are a summary of the symbols used in the text and a notation on each right-hand page telling on which page the current references may be found. Finally, the prose is forceful and direct, the 'good mother English' that Charles Darwin recommended in scientific composition.

I recommend this book highly and count it as a valuable addition to the literature of ion exchange.

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About the Reviewer: Lawrence Dresner has been a physicist at the Oak Ridge National Laboratory since 1954. His work, until recently, has been in the fields of reactor and nuclear physics. He is currently working on the problem of purifying salt water.

Effects of Radiation on Materials and Components. Edited by J. F. Kircher and R. E. Bowman. Reinhold, New York, (1964). 690 pp., $22.50.

This book is a condensed summary of information on the radiation-induced changes in materials, components and equipment exposed or operated in a nuclear radiation environment. The stated objective is to draw together much of the engineering data generated under various nuclear programs of the last several years; much of this information has been previously available only through government agency or contractor reports. Throughout the book, emphasis is placed on those aspects of radiation effects that are important in engineering applications, i.e. the physical and mechanical property changes of materials, the performance changes of components, and the radiation intensities or dosages that produce these changes. Accordingly the book will be of interest principally to those concerned with the study, design and performance of equipment for reactor, hot-cell and space radiation environments.

The contents include several chapters on individual categories of materials and two devoted specifically to semiconductor devices and electronic components. Introductory chapters which will be particularly welcomed by many engineers cover basic concepts of radiation damage and dosimetry. Interactions of gamma rays, electrons and neutrons with matter are briefly described together with the general types of reactions leading to damage in different categories of materials. Dosimetry definitions, units and measurements

are similarly briefly, but completely, treated in the second chapter. There follow five chapters on different categories of materials; these include polymers (both rubbers and plastics), fuels and lubricants, organic compounds, ceramics and structural metals and alloys. In addition to materials data, each of these chapters considers components or applications of the materials such as rubber hoses, adhesives, electrical insulation, heat transfer fluids, refrigerants, thermal insulation, cements and many others. The final chapters on semiconductor devices and electronic components emphasize performance changes as well as material degradation.

For the presentation of such a range of subject material, the authors have chosen an encyclopedic rather than handbook approach, the aim being "to provide more in the way of engineering data and yet more background and general information than the usual handbook." Thus, the information is presented principally in descriptive condensations supplemented by tabular and graphical summaries. The usual chapter includes a few pages outlining the types of interactions and a qualitative description of the mechanisms of damage that occur in the subject materials. Condensations of the information organized into material, application or component categories follow. In the chapters on materials such as organic compounds, which have been extensively studied and for which other detailed references exist, the discussion is concentrated on representative or illustrative data. For the much less extensive and less accessible data on components of various types, the presentation approaches a more complete listing of the pertinent information. Since the state of knowledge in this field ranges from one based solely on qualitative observations to one derived from detailed studies, this approach seems appropriate both for purposes of eliminating unnecessary details and for presentation of the often meager information, and it is one that the authors are well qualified to present. The editors and many of the authors of the individual chapters are, or have been, associated with the government-sponsored Radiation Effects Information Center, an association that has provided a thorough knowledge of the information available, of the significant problems involved and of the design engineer's viewpoint.

The book is the best single-source reference for the subject matter available at this time. Readers can expect to obtain information on the extent of data available in a given area, together with references, the amounts of radiation necessary to produce significant changes, and the types of changes of importance. Since much of the information presented was obtained or initiated during the nuclear aircraft program, the topical references are relatively complete and up-to-date, the latest references cited being 1962. From one hundred to three hundred references are cited for each chapter, and subject and author indices are included.

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About the Reviewer: C. G. Collins has been active in radiation-effects studies of all types of materials since 1947. During much of this period, he was associated with the Aircraft Nuclear Propulsion Program and directed studies of radiation effects on materials and performance of reactor accessories and on jet engine and aircraft components. He is currently Consultant, Irradiation Effects, at the Nuclear Materials and Propulsion Operation of the General Electric Company.