it to instructors who are willing to fill in the gaps with more perspective than is provided in the text. To those elderly nuclear engineers who would like to buy an up-to-date book for the shelf – keep hoping, but save your money for now.

Robert C. Axtmann
Princeton University
Princeton, New Jersey

(About the reviewer: Since 1959 Robert C. Axtmann has been Socony Mobil Associate Professor of Nuclear Studies in Princeton University's School of Engineering and Applied Science. He teaches nuclear physics (to engineers) and reactor theory (to anybody). Earlier assignments include two years in the Physics Division at ANL and seven years at Savannah River.)

Radiation Effects on Organic Materials. Edited by Robert O. Bolt and James G. Carroll. Academic Press, New York and London, 1963, 576 pp., $13.50.

Prepared under the auspices of the Division of Technical Information of the United States Atomic Energy Commission, this collection of essays is concerned with nuclear radiation and its effects on the properties of organic liquids, solids, and gases.

A broad gamut of subjects and materials are covered in the sixteen chapters by the thirteen contributing authors and co-authors. In sequence from Chapters 1-16, the titles of the chapters are: Introduction; Interaction of Radiation with Matter; Mechanisms of Chemical Effects of Ionizing Radiation; Radiation Chemistry of Pure Compounds; Polymers; Plastics; Elastomeric Materials; Coolants; Lubricants; Adhesives; Textiles; Coatings and Films; Dielectric Fluids; Fuels and Fluid Shield Materials; Coal, Wood and Explosives; and Potential Benefits.

Although the book is well written in general, special mention should be made of the clarity of presentation of the second and third chapters by Amos S. Newton on the Interaction of Radiation with Matter and the Mechanisms of Chemical Effects of Ionizing Radiation. Considerable thought and scholarly attention must have been devoted to these two chapters.

The editors have done a very commendable job. No really serious errors were detected, the book is well referenced, and the format and writing is very readable.

Perhaps the outstanding feature of the book is its extensive coverage of the literature. Although there are some definite errors of omission, a considerable amount of literature has been cited which is not too readily available.

About the only mildly negative reaction this reviewer underwent in perusing this volume was an apparent lack of coherence. However, this lack is somewhat inherent in any collection of essays by various authors.

In summary, this book is an excellent reference text, and it will prove very useful to any engineer who might have design or material problems involving radiation effects on organic materials.

Dr. Vincent P. Calkins
General Electric-Nuclear Materials
and Propulsion Operation
Cincinnati (Evandale), Ohio

(About the Reviewer: Dr. Vincent P. Calkins is currently Manager, Nuclear Materials at the General Electric-Nuclear Materials and Propulsion Operation in Cincinnati (Evandale), Ohio. He worked on the Manhattan Project at Iowa State University under Dr. F. H. Spedding and on the NEPA Project at Oak Ridge. His fields of interest include: selection of materials for nuclear reactors; the chemistry, ceramics, and metallurgy of high temperature materials; and basic phenomena of physics.)

Fabrication of Control Rods for Nuclear Reactors. By William E. Ray, Rowman and Littlefield, Inc., New York, (1963). $6.95.

This is one of a new monograph series on Metallurgy in Nuclear Technology produced by the American Society for Metals under sponsorship of the Atomic Energy Commission. According to the author's preface it is directed toward acquainting those "engaged in non-nuclear metallurgical work with the fabrication procedures for producing control rods for nuclear power reactors."

The sponsors could not have picked a more knowledgeable man to write this monograph than William E. Ray. Mr. Ray spent the years from 1955 to 1960 with the General Electric Co., at the Knolls Atomic Power Laboratory, and during this period a major part of his efforts were directed toward development of novel control/poison systems with a special effort directed toward improvement of fabrication technology. Subsequently, while with Dresser Products Inc., he retained this interest both in development and production. Rods for several of the current crop of new reactors, including the Experimental Gas Cooled Reactor and the Molten Salt Experiment at Oak Ridge as well as BONUS Reactor in Puerto Rico were built under his direction. In addition,

he developed several novel fabrication techniques for special control rods during this period.

The book begins with the usual Introduction as Chapter 1. Chapters 2 through 9 present information on properties of the commonly used control rod materials which would be useful to those engaged in fabrication of such rods. These chapters depend rather heavily on a well chosen system of references headed by Anderson and Theilacker on "Neutron Absorber Materials for Reactor Control" and selected papers from the early Symposium on Control Materials published in the September, 1958 issue of *Nuclear Science and Engineering*. (It might be noted that Mr. Ray was a strong contributor to both of these publications.)

Chapters 10 through 12 pay special attention to documentation of the fabrication technology. Chapter 13 deals with procedures for quality assurance of control rods. Since proper functioning of control rods is a critical factor in reactor safety, due attention to such quality assurance becomes a very important consideration.

The last chapter, numbered 14, contains the usual effort by authors to use a crystal ball and predict future developments. (It is this reviewer's experience that such guesses usually turn out to be wrong.)

An adequate index is provided. The usual difficulty was encountered in guessing as to which cubby hole the indexer had chosen in which to file a given item. Experience teaches, however, that such a guessing game must always be played with the index-writers of new technical books and in this case only reasonable ingenuity was needed to win the game. The conclusion was that if Ray put it in the book, Anderson could find it, generally without resort to thumbing, by using the index.

There are, as usual, some faults with the book. Principal among these are obvious errors in word selection, semantics or grammar which more careful editing should have eliminated. Typical of these is the lead-off sentence in Chapter 6. Quoting: "Cadmium was used to control the first self-sustaining nuclear chain *reactor* in the CP-1 reactor at the University of Chicago in 1942." Obviously Mr. Ray intended that the itallicized word be *reaction* rather than *reactor*. Also, there are some obvious errors of omission such as one in Fig. 74 on page 164. Here in a flow sheet depicting Leittens technique for making Eu_2O_3/stainless steel dispersions from elemental powders Mr. Ray has no iron in his stainless steel. This caused a bit of a semantic block and brought the reviewer into some confusion and worry when due search failed to reveal the missing iron.

A similar example of a sin of omission seems obvious on looking at Table 1 in Chapter 1. If samarium with its 13.8% of a single high-cross-section isotope is worth listing, why omit gadolinium with two high-cross-section isotopes totaling 30.4% of the naturally occurring mixture?

These faults, however, are not too serious, and certainly the volume deserves a place on the bookshelf of any nuclear materials engineer who has any serious interest in control rods, their development or production. Although directed toward the practicing metallurgist or engineer, the book can easily be read with benefit by advanced undergraduate students in engineering. Mr. Ray does not indulge in pedantry. Rather he assumes the stance of a good workman discussing a subject to which he has contributed with an audience of his peers. This reviewer can recommend the book to either the beginning engineer or the practicing technologist as a source of accurate information in the field of fabrication technology for control rods in nuclear power reactors.

Dr. W. Kermit Anderson

General Electric Company
Schenectady, New York

(About the Reviewer: Dr. W. Kermit Anderson is Consultant - Materials Engineering to the staff of the Materials Development Operation at the Knolls Atomic Power Laboratory. His interest in neutron absorber materials was first aroused during a search for high efficiency shielding materials while employed by the NEPA Project at Oak Ridge. This interest was maintained during employment at the Argonne National Laboratory and more recently at the Knolls Atomic Power Laboratory where this work has led to several publications in the field. These include joint contributions with J.S. Theilacker and others, including W.E. Ray, to writing and editing the book, "Neutron Absorber Materials for Reactor Control," published for the U.S.A.E.C. by the U.S. Government Printing Office in 1962.)

Materials for Control Rod Drive Mechanisms. By George A. Freund. Rowman and Littlefield, Inc., New York, 1963. 209 pages. Paperback $4.45; Hard cover $6.95.

Several years ago the Atomic Energy Commission contracted with the American Society for Metals for six monographs on metallurgy in nuclear technology. The present volume is the third in the series. The reader may note a similarity to the British Nuclear Engineering Monographs by Temple Press, Ltd.

The one word which best describes Freund's book is "concise". Eleven well-written chapters