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Book Reviews

Neutron Absorber Materials for Reactor Control. Edited by W. KERMIT ANDERSON AND J. S. THEILACKER. U. S. Atomic Energy Commission, Naval Reactors, Division of Reactor Development, 1962, 862 pp. $3.00 (paper cover).

Neutron Absorber Materials for Reactor Control, edited by by W. Kermit Anderson and J. S. Theilacker, is the eleventh and current handbook in the series sponsored by the Naval Reactors Group of The U. S. Atomic Energy Commission. The editors have assembled into one volume the vast amounts of experimental data accumulated in recent years under the sponsorship of the Naval Reactors Group. Each of the chapters has been separately assembled and edited by one of several contributing editors; many of the subchapter headings have also been separately authored: the work of 66 authors is included in this one volume. These writers are largely (but not exclusively) from laboratories involved with Naval Reactors development, especially General Electric's Knolls Atomic Power Laboratory and Westinghouse's Bettis Atomic Power Division. The resulting book, therefore, places heavy emphasis on the development of control materials for Naval Reactors and the Shippingport PWR, and largely—but regrettably—ignores some excellent work on reactor control materials sponsored by other agencies.

The book begins with an excellent 40-page summary describing "Neutron-absorbing Materials and Their Application to Nuclear Reactors" which is followed by a 100-page discussion of "Control Materials Theory and Calculations for Thermal Reactors." (Omission of a detailed discussion of control of fast reactors and the omission previously cited suggest the title is more general than the text.) Both of these chapters tend to minimize the importance of the lanthanon poisons, especially Dy: for example, a footnote on page 146 refers to recent (1959!) KAPL data that the poison residue from Dy after burnup is appreciably higher than originally anticipated; the conclusion is then drawn that the usefulness of Dy as a burnable poison is "in serious doubt" without mention of the potential usefulness of Dy as a control material indicated by these same data. Chapter I states the important disadvantages of the lanthanons without mentioning their potential advantages of high cross-section daughter products (of Eu and Dy) and minimum radiation damage anticipated from transmutation to chemically and atomistically similar elements. It thus appears that these two chapters reflect the opinions of their authors at a time several years earlier than the 1962 publication date; Chapter II contains no references more recent than the 1959 footnote.

The book then continues with detailed discussions of the information on hafnium, boron, silver alloys, and rare-earth control materials. The nuclear, chemical, physical, and fabrication properties of each are described. The relative lengths of these chapters is more indicative of the amount of research performed on each material than on its relative merit as a control rod. The chapter on hafnium is brief and well-written, and properly makes reference for details to the 1960 book "The Metallurgy of Hafnium" by D. E. Thomas and E. T. Hayes. The chapter on boron is far too long (233 pages) in view of the serious disadvantages of boron in any form as a high burnup control rod material. The chapters on silver alloys and the lanthanons are more reasonable in length (approximately 100 pages each) but still quite detailed—justifiably so, since most of this information has not previously been assembled into one volume. The chapter on the lanthanons also appears to be out of date for a 1962 reference book.

The final three chapters describe fabrication of control rods, the use of unshielded burnable poison materials and elements, and the fabrication and use of discrete, self-shielded, burnable poison elements. Emphasis is on completeness, which results in some overlap with the preceding chapters. For example, both Chapters 4 and 9 tabulate radiation-effects data on boron-stainless steels without cross-reference. The index refers to the former but not the latter table.

At the end of Chapter I, the writers state that this book is intended to "serve as a guide to the metallurgist who is responsible for materials development and to the reactor designer who is responsible for materials selection." The first purpose has been well served; the book contains a well-documented survey of control-rod materials development. The latter purpose is not as well served, largely because information is being generated so rapidly in this field that many of the discussions have become obsolete during the several years time that obviously elapsed between the writing and the publication of this book.

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(About the Reviewer: Dr. John R. Weeks is currently group leader in corrosion research in the Metallurgy Division at Brookhaven National Laboratory. He received an E. Met. from the Colorado School of Mines in 1949, and was a research assistant at the University of Utah from 1949 to 1953, receiving an M.S. in 1950 and a Ph.D. in Metallurgy in 1953. Since coming to Brookhaven in 1953 he has been engaged in research in liquid metal corrosion and liquid metal fuel constitution, and is currently materials consultant for the high flux beam reactor under construction at Brookhaven.)