Book Reviews

The Rare Earths. Edited by F. H. SPEDDING AND A. H. DAANE. Wiley, New York. 1961. 641 pp. $14.75.

The Rare Earths is a book containing the papers presented at a symposium co-sponsored by the American Society for Metals and the Atomic Energy Commission in November of 1959. F. H. Spedding and A. H. Daane, the organizers of the symposium and the editors of this volume, have on the whole made good choices of the authors of the papers–chapters of the book. The material is presented in an interesting manner, is well written, and appears to be up-to-date. The editors could have reworked the introductions to some chapters to avoid repetition. The book is concerned with the rare earths and the associated elements lanthanum, yttrium, and scandium. It is obvious from reading this book that the so called rare earths can no longer be considered rare and are now readily available in moderate purity in quantity for research and commercial application. This reviewer was surprised to learn that 29,000 lb of yttrium metal was prepared between 1957 and 1959.

The book is broken down into four main sections; (I) Occurrence and Extraction of Rare Earths, (II) Preparation of Rare Earth Metals, (III) Properties of Rare Earth Metals and Alloys, and (IV) Applications of Rare Earth Metals and Compounds. The first section is subdivided into five chapters, the first of which is a very interesting one entitled, "Historical Introduction to the Rare Earths." This is followed by a chapter on the chemistry of the rare earths and three chapters on the separation methods.

The second section covers the preparation of the fluorides and halides of these metals—chapters 6, 7, and the reduction methods—chapters 8, 9, and 10. Since the production methods yield material of commercial purity there is a chapter (11) on purification followed by a chapter (12) on fabrication.

In the first three chapters (13, 14, 15) of the third section the physical properties, the crystallography, and metallography of the rare earths are presented. Chapters (16, 17), entitled "Rare Earth Metal Phase Diagrams" (there are 95 complete phase diagrams, and a resume of information available on the other rare earth phase diagrams) and "Principles of the Alloying Behavior of Rare Earths," are excellent. The section is concluded with the chapter on the mechanical properties of yttrium, scandium, and rare earths.

The final section covers applications to magnesium technology and ferrous and non ferrous alloys, non nuclear uses, and nuclear applications (chapters 19, 20, 21, 22). The concluding chapters present the analytical chemistry and analytical spectroscopy of the rare earths.

A number of books are being published which are collections of papers presented at symposiums. This book differs from most of the ones the reviewer has seen in that there is good continuity from chapter to chapter. This reviewer, who has not worked with rare earths, enjoyed reading this book and can recommend it as an introduction and a source book to the rare earths.

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(About the Reviewer: Dr. David H. Gurinsky is Head of the Metallurgy Division of Brookhaven National Laboratory. After receiving his Ph.D. at New York University in 1942, he joined the University of Chicago Metallurgical Laboratory, and after two years transferred to Los Alamos and then back to the University of Chicago. He has been at Brookhaven since 1947 and is a Fellow of the Society.)

Textbook of Reactor Physics. By J. F. HILL. Allen & Unwin, London, 1961. 228 pp., 76 figures, and 35 tables. 36s ($5.04).

This small book was written by a former principal of the Reactor School at Harwell under the auspices of the United Kingdom Atomic Energy Authority. The philosophy behind the book can, perhaps, be indicated best by quoting from the author's preface.

"A large number of advanced textbooks on reactor physics is available, but there are very few suitable for readers with a limited knowledge of mathematics. Many people now concerned with reactor design work require to understand the elementary principles of reactor physics, and I have therefore tried to explain these principles to the non-specialist, using the minimum of mathematics while retaining as complete an account as possible; this book also aims to serve as an introduction to the subject and as a preparation for further reading for those who are better equipped mathematically."

The book opens with a review of those aspects of atomic and nuclear physics which are pertinent to reactor physics. The review is brief and to the point. There follows an excellent introductory description of the chain reaction and a survey of problems encountered in reactor physics and design.

After discussing the behavior of neutrons in moderating media, the author goes on to the calculation of the reactor parameters, first for homogeneous reactors, then for heterogeneous reactors. He concludes with an account of the effects of fission product buildup, temperature changes, and fuel depletion and with a discussion of reactor kinetics.

In order to give the reader a feeling for the subject, numerous graphs and tables are given. Most of the figures are plots of reactor parameters, fluxes, etc. In the later chapters extensive lists of formulas are given, the derivation and origin of which are, of course, impossible to give in the space allotted. An appendix lists thermal cross sections of the elements.