# Book Reviews

**Nuclear Reactor Materials.** By B. R. T. FROST AND M. B. WALDRON. Simmons-Boardman, New York, 1959. 79 pp., paperback, $2.75.

This book is one of a series of Nuclear Engineering Monographs providing succinct coverage of various reactor disciplines on a college student level.

This volume is based on a series of lectures by the Harwell Metallurgy staff. The six chapters cover the fields of Theoretical Metallurgy, Structural Materials, Fuel Materials, Liquid Metals, Ceramics-Cermets, and Corrosion. An excellent bibliography is provided for supplementary studies, plus a brief index.

The author-editors are the eminent Drs. Frost and Waldron, Principal Scientific Officers of the United Kingdom Atomic Energy Research Establishment at Harwell.

In view of the size of our own Reactor Handbook Materials volume the task of condensation to 79 pages is formidable indeed. The authors have provided an admirable panorama of the highlights of the nuclear materials spectrum. The text is very well written and is generally adequately fortified by suitable tables, charts and drawings. Typographical errors are infrequent; the reviewer will contact the authors directly regarding corrections and possible changes for a revised edition.

As would be expected the text has a slight bias toward gas-cooled reactors. Also the reviewer senses perhaps excessive tact in the treatment of some of our American reactor projects; for example, the Liquid Metal Fuel Reactor (p. 46) and the Homogeneous Reactor (p. 73). The "no details available" on the Seawolf is disturbing (p. 44); this reactor had many interesting features which we should make available, particularly since it has been displaced for submarine propulsion.

Now let us consider a few specific areas as follows: A good supplement to the theoretical metallurgy chapter would be the Williams and Homerberg text (on which the reviewer was weaned). The beryllium ductility dream is now showing faint promise of realization in the zone purification work by Wilsdorf at Franklin Institute (p. 30). There is considerable interest in the recent development of pyrolitic graphite and also the so-called "impervious" graphite (p. 61). The motivation behind our flurry on hydrides is their remarkably high hydrogen content per unit volume (p. 62). The thorium description might as well mention the activity build-up after reprocessing; this is no small problem (p. 40).

For his dessert the reviewer now selects zirconium and hafnium, having developed a fondness for these metals, as coordinator of their development in the Naval Reactors Branch. The statement on page 33 regarding the development of zirconium technology is not clear. Close examination of the careers of titanium and zirconium will reveal that despite similarities and a stronger start for titanium, the zirconium field did pioneer in several important areas. This debt of "big brother" to "little brother" has not been generally appreciated. Regarding the Zr vs. Al battle one should bear in mind that whereas designers once prayed for corrosion resistance they now clamor for strength (pp. 28, 72).

Finally, a section on control (p. 62) is hardly complete without hafnium (p. 73) and Cd alloys, neither belonging in the category of the chapter title.

In conclusion the authors are to be commended for their contribution in this compact materials volume. The intended audience will find it both enjoyable and quite useful.

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*(Editor's Note: Mr. Kerze is currently Chief of the Technical and Economic Data Section of the U.S. Atomic Energy Commission's Division of Reactor Development. His experience in reactor materials is extensive. After working with Prof. H. C. Urey on $H_2$-$D_2$ catalytic exchange and $UF_6$ purification at Columbia University in 1940 to 1942, he taught Chemical Engineering at New York University for 4 years. Following this, he spent 4 years at Oak Ridge National Laboratory in the development of MTR fuel elements, as well as the beryllium reflector and the control and shim rods for that reactor. From 1950 to 1955 he was on Admiral Rickover's staff where he was concerned principally with the development of zirconium and hafnium. He was principally responsible for the development of the hafnium control rods for naval reactors. From 1955 to 1958 he was in charge of spent fuel reprocessing programs.)*

**Nuclear Propulsion.** Edited by M. W. THRING. Butterworths, London, 1960. 300 pp., 80 figures, index. $9.50.

*Nuclear Propulsion*, edited by M. W. Thring of Sheffield University, is a collection of 16 related essays, written by 13 different authors, intended as an introduction to the field of nuclear propulsion. Its contents span the entire range of scientific specialties involved in this field: nuclear physics, reactor design, the thermodynamics of jet and rocket propulsion, heat transfer, metallurgy, ship design, and some aspects of medicine and biology. Because of this the essays are very simply written. Those devoted to basic sciences record coherently, but without any proof or argument, the essential relevant facts. Others sketch the limitations of the various technologies. The rest describe the constraints put by these facts and limitations on the design of nuclear propulsion systems. The style is introductory, and none of the chapters requires anything more than an ordinary scientific or engineering background to be understood.

The book begins abruptly with a chapter about the structure of the nucleus and nuclear reactions, there being neither