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Book Reviews

Heavy Water Exponential Experiments Using ThO_2 and UO_2. By J. A. THIE. Pergamon Press, New York, 1961. 170 pp. $6.00.

The book is one of a series of monographs on Nuclear Energy and is designed as a reference source for the experimental nuclear physicist, reactor theorist, or reactor designer who is planning an exponential experiment or requires information that may be obtained from one. Source material for the book is from work that has been performed on uranium (UO_2) and thorium oxide (ThO_2) fuel exponentials, using heavy water (D_2O) as a moderator and the data is confined to that which has been published. This work was carried out in laboratories in Norway, Sweden, France, Canada, and the USA. The text is arranged in a logical order and covers the subject matter in a comprehensive manner. It first gives an explanation of the types and uses of exponential experiments. This is followed by the results of actual experimental measurements on oxide fueled, heavy water experiments performed in several countries with an interpretation and analysis of each set of data. The last section of the book elaborates on the considerations that may be given by those planning an exponential experiment.

It is a well written text and demonstrates the knowledge and understanding that Dr. Thie has of the field of experimental and theoretical physics. The book has not been directed towards the need of the undergraduate college students in a study program in nuclear engineering, because an understanding of the theoretical physics interpretation of the exponential experiments used in the book requires a knowledge in nuclear engineering which is beyond the undergraduate college level. It presents no new information or concepts in the area of exponential work, but is simply a collection, with analysis, of some oxide-heavy water experiments that have been performed in several countries. It is sufficiently illustrated with tables and figures to portray the desired information.

The information contained in the book is of special significance to reactor technology at this time due to the interest of many reactor design groups in the use of UO_2 and THO_2 as possible reactor fuel materials. A review of the tables reveals some differences in the measured values of bucklings in the separate experiments which appear to have about the same geometry and lattice spacing. Even though these small variations may be due to differences in the experiments, it would be helpful if some discussion were given on them. It would also be of some value to discuss the use and limitation of the two-group theory as used to determine various physical constants for the type of systems described. This is important in view of the application and accuracy of two-group theory in representing the properties of reactors that are heavy water moderated. When calculated bucklings are compared to measured values for the systems there is very close agreement over a large range of k_∞. This close agreement is understandable for the low values of k_∞; however, for the higher values, where the resonance effect is much more important, it is not clear that the equations used for the calculations would still produce the same agreement with measured values. It would be well if this were given consideration in the text.

This book is certainly worth reading and is an excellent reference book for those interested in operating or planning an exponential experiment.

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(About the Reviewer: Milton C. Edlund is manager of the Marketing Department, Atomic Energy Division, The Babcock and Wilcox Company, Lynchburg, Virginia. He is best known for being the coauthor of the classic Glasstone and Edlund text, Elements of Nuclear Reactor Theory. *He was at Oak Ridge National Laboratory from 1949 until 1955 as a reactor physicist on various reactor projects and as a lecturer in reactor physics at the Oak Ridge School of Reactor Technology. From 1951 to 1952 he assisted Professor Eugene Wigner in conducting a course in the theory of nuclear chain reactors at Princeton University, and in 1953 was visiting lecturer at the laboratories of the Swedish Atomic Energy Company.)*

Radioisotopes in the Physical Sciences and Industry: Proceedings of the Joint IAEA-UNESCO Conference at Copenhagen, (September 1960). International Publications, New York, 1962. Vol. I, 542 pp.; Vol. II, 554 pp.; Vol. III, 620 pp.; $8.00 per volume.

The three-volume publication, *Radioisotopes in the Physical Sciences and Industry,* is in this reviewer's opinion the high point of the publications of the International Atomic Energy Agency. In three volumes it brings together a most impressive collection of individual papers demonstrating the wide scope and power of radioisotopes throughout science and industry. Though it does not emphasize the biological sciences, it is clear that the methods described apply there also. It would be very difficult in the short space allotted to do any justice to the individual papers. Typical and indicative of the content however is the first paper in Volume I on "Meteorites as Space Probes for Cosmic Rays" by Schaeffer, Stoenner, and Davis. The cosmic rays generate radioactive isotopes in meteorites in their orbital path. By choosing isotopes of appropriate half-life, limits were set on the variation in cosmic ray intensity in both space and time. The eerie footprints thus left by the cosmic rays tell us the past story for our local

part of the cosmos with amazing clarity and definiteness. This paper is one of a considerable number now in the literature on this subject, but it represents in these three volumes a new application of isotopes of wide and fundamental importance.

It is a pleasure to recommend these volumes and encourage their wide use. There are few subjects so sadly neglected in education today as radioactive isotopes and their applications. They would aid the development of our technology and our science much more if it were taken for granted that the material in these books should be known to most science and engineering graduates.

In addition to the brilliant section on applications in geophysics there are sections on metallurgy and solid state physics, nuclear physics, and two large sections aggregating about 400 pages on industry in general. There is a section on instrumentation and also one on isotope production.

In view of the recent spectacular application of isotopic methodology to the proof on analysis of a few hairs that Napoleon had eaten considerable quantities of arsenic before his death, the section on analytical methods should be mentioned with emphasis.

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(About the Reviewer: Willard F. Libby, Professor of Chemistry at the University of California in Los Angeles, is perhaps best known for his work on radiocarbon dating, for his terms of office with the AEC from 1954 to 1959, and for being the Nobel Laureate in Chemistry in 1960. Other prizes he has received include the 1956 American Chemical Society's award for nuclear applications in chemistry, their Willard Gibbs Medal Award in 1958, and the Albert Einstein Medal Award in 1959. He was active on the Manhattan Project at Columbia University during the war, and at the Institute for Nuclear Studies of the University of Chicago for the postwar decade.)