

Book Reviews

New Nuclear Materials Including Non-Metallic Fuels. Volume I and II. Published by International Atomic Energy Agency, Vienna, Austria, 1963. Distributed by International Publications, Inc., 317 East 34th Street, New York 16, New York. Volume I—563 pages—\$11.00; Volume II—568 pages—\$11.00.

These two volumes, which summarize the proceedings of the conference on New Nuclear Materials Technology, Including Non-Metallic Fuel Elements, held by the International Atomic Energy Agency in Prague, 1-5 July, 1963, contain a wealth of practical information and attest to the wisdom in selection shown by the judges of the original papers. However, the title almost apologetically includes non-metallic fuels whereas in truth 21 of 34 papers in Volume I concern uranium dioxide, and the majority of the remaining papers deal with uranium carbide or uranium nitride. Roughly the same balance holds for Volume II. However, this is hardly a fault since the articles do concern themselves with an area of new materials technology.

A critique of the book itself cannot help but be a critique of the conference. However, with regard to the two volumes, most of the articles were informative and especially useful to practicing industrial workers in uranium dioxide technology. Many of the papers contain valuable arts and procedures for solving troublesome problems. However, the series does suffer from one very severe problem. This is the employment of many languages for the articles. English predominates but many are in French, Italian and Russian, which greatly detracts from the value as a reference work to those not fluent in these languages. It is highly commendable that the IAEA would be impartial, but reality indicates that English is by far the most popular language in the scientific world, at least outside the Iron Curtain countries. Some of the articles with intriguing summaries have not yet been translated for the reviewer, and somehow this gives one almost a sense of being cheated out of some choice bits of information.

Volume I starts with a fine informative article on Les Combustibles Non Metalliques by R. Caillat.

The most recent data on uranium dioxide is reviewed and added to, and some data on plutonium compounds are included.

The recent work on electrolysis from molten salt systems performed at Hanford is presented and the problems nicely delineated. As can be expected, considerable technology in the handling of molten chloride systems is being developed here. The information on 'dry' molten salts is a revelation and could explain many observations made by previous workers. The photos and properties of the electrolytic uranium dioxide are quite intriguing.

Some very interesting data on precipitation of uranium and thorium oxalates, which can be extended to other systems, is presented by Cogliati *et al.* The observed changes of settling rates and filtering rates as functions of temperature, time, aging or digestion are directly translatable to other precipitation systems.

Another very intriguing article, full of promise for future applications, is the article on the electrochemical reductions as a way of preparing uranium dioxide. Again the article is rich in techniques and practical applications.

The practical aspects of the volumes continue with a fine description of the French process for preparing pellets. It is illuminating to see that others have the same problems as we do and to see that the solution is so similar.

The Russian work on the phase transformations and specific surfaces in the manufacture of uranium dioxide from ammonium diuranate is one of those articles where the graphs, photos, tables, etc. seem very intriguing but the language barrier prevents real digestion of what appears to be some excellent data.

Preparative chemistry and techniques continue to be presented throughout the remainder of Volume I, primarily, as mentioned, on uranium dioxide.

It is very evident from these volumes that the Russians are doing some fine basic work on uranium dioxide, and it would behoove the professional worker in this field to acquire at least a reading knowledge of scientific Russian. Their work is fundamental, definitely applied and well done.

Volume I finally leaves uranium dioxide and presents some fine data on the fabrication of beryllia powder into pieces by sintering, but continues to bring uranium dioxide back into focus, leaving very little doubt as to the most important fuel material in use today.

The carbides are given a fair coverage and the nitrides a very brief run down. The work presented seems quite informative and of much interest to those working in these technologies.

To summarize, Volume I has a wealth of very practical fabrication and handling technology on uranium dioxide. It cannot help but be a good source book of techniques and ideas for those intimately concerned with uranium dioxide fabrication technology. It will be a disappointment to most who approach a subject primarily from a theoretical standpoint for there is really very little (although some) theoretical treatment of the whole subject of sintering and fabrication.

Volume II leaves the technology field to some extent and presents some data on irradiation behavior and analysis of a special nature.

The thermal conductivity of uranium dioxide is again explored by J. A. L. Robertson with the continuing discussion of what constitutes melting in uranium dioxide. This is always interesting and provocative and Robertson's article is well done. He helps solidify the strong position of UO_2 .

Dispersion fuels come in for a few articles but it would seem that except for special applications, dispersion fuels are not going to compete with sintered uranium dioxide for very long. The article on the fabrication of stainless-steel UO_2 -fuel plates is very well written and full of some very interesting observations and data.

The French work on the thermal conductivity of UO_2 is rich in experimental techniques and in results. This work is discussed at length and really poses an interesting problem because the results are so much lower than those of Hanford and Chalk River.

Volume II is of a significantly different scope than Volume I. In Volume I, the emphasis is on the manipulation of uranium dioxide, whereas in Volume II, it is hard to define what the true scope is supposed to be. Of the two volumes, Volume I most appealed to the reviewer because it dealt with work closer to his interest. Volume II will probably be of similar import for workers in the field of irradiation performance, thermal conductivity of uranium dioxide and cermet technology.

In summary, the volumes contain a wealth of practical technology and reports on work carried out in the last few years. It is obvious that not all of the reported work is the very latest, but it does summarize some of the more solidified processes of Europe and to some extent the U. S. The re-

viewer has had two occasions in the short time the volumes have been in his possession to use the material as conference table references to support development ideas and discussions. Each time the material was scanned for review purposes a new article came under close scrutiny and this promises to continue for some time in the future. The volumes belong on the shelf of any industrial organization concerned with the technology of uranium, especially uranium dioxide.

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About the Reviewer: William R. DeHollander is a specialist in Nuclear Fuels and Materials at the General Electric Company's Atomic Power Equipment Department where he has been since 1959. Prior to this, he was at the Hanford Works. Dr. DeHollander received his Ph.D. degree in Physical Chemistry from the University of Washington in 1951. He has been in the nuclear field since that time.

Laboratory Training Manual on the Use of Isotopes and Radiation in Soil-Plant Relations Research. International Atomic Energy Agency—Technical Report Series No. 29 (165 pages). Available from National Agency for International Publications, Inc., 317 East 34th Street, New York, N. Y. 10016. 165 pages. \$3.50.

This volume is a joint undertaking of the IAEA and the FAO and is a very compact treatment of radiation and radioactivity techniques.

The manual is an outgrowth of a series of courses given by the United Nations Expanded Program of Technical Assistance. A number of instructors have participated in the courses but the present volume was developed by Victor Middleboe and a panel of scientists meeting in Vienna in 1962. A large number of workers in the field have contributed to the manual although no specific credit is given either to the writers of particular sections or to the sources of the lecture material or the laboratory experiments.

The book is divided into a basic part and an applied part, with each section being subdivided into introductory material and laboratory exercises. The lecture material in the basic part is an excellent summary of the standard lecture material included in most courses. Radioactive decay, interaction of radiation with matter, radiation detection, and health physics are included in the first thirty pages or so. The next twenty pages