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## UN VÉRITABLE CLASSIQUE

**Title** Plutonium Handbook (a guide to the technology) Vol. I

**Editor** O. J. Wick

**Publisher** Gordon and Breach Science Publishers, Inc., 1967

**Pages** v + 520

**Price** \$15.00 professional edition; \$26.00 reference edition

**Reviewer** F. Sebillau

This book is the first of a series of two. It is intended to provide information on a broad range of topics in the use of plutonium and to provide a primary reference to its technology. The authors of this handbook are very well known in the field of plutonium technology; in fact, most of them did pioneering work and made important contributions to our knowledge of this subject.

The *Plutonium Handbook* is a valuable guide not only for people who are not acquainted with plutonium technology but for those who are currently engaged in this field, for they can find all the available data collected in a unique reference book. However, due to editing delay, liter-

ature references subsequent to 1964 are not given. For that reason, it would be of considerable interest to rapidly undertake either a new edition of the book or the publication of a supplement including later references. The latter could probably be made in a shorter time.

In Chaps. 1 and 2, nuclear properties of plutonium isotopes are described. This description constitutes a broad survey of the subject, well adapted for technological purposes. Nevertheless, though alpha and beta emission of plutonium isotopes are given in detail, gamma-ray emission is not mentioned. In the same way, occurrence of  $^{241}\text{Am}$  by beta decay of  $^{241}\text{Pu}$  and associated gamma emission should have been pointed out since it affects plutonium handling safety.

Finally, in considering nuclear reactions (Chap. 2), it seems that some comparison between the neutron capture cross sections of isotopes of uranium and those of the plutonium isotopes, emphasizing the difference between these two elements with respect to the production of the heavier isotopes, would help in understanding their different characteristics.

Chapters 3 through 10 deal with metallurgy in the broad sense (since the properties of plutonium refractory compounds are included). Physical properties of pure plutonium are described in detail. Apparently no comment is made on the negative expansion coefficient of the delta phase, and there are only a few words on the electronic structure of plutonium. It should be remembered that most studies of magnetic and electronic properties of plutonium and plutonium alloys have been undertaken in an attempt to throw some light on the electronic structure, though the question still remains partially unanswered.

Mechanical properties of plutonium and plutonium alloys are given extensively in Chap. 4. In Chap. 5, solid-state reactions are considered, i.e., allotropic transformations of pure plutonium and transformations in plutonium alloys. Only a few data are given on self-diffusion in delta plutonium, which may give the reader the impression that solid-state diffusion of plutonium is a nearly unexplored field. This sparsity is probably due to the limited work in this field prior to 1964.

Chapter 6, on corrosion and oxidation, begins with an interesting survey of the general corrosion behavior of plutonium and its alloys. One can deplore with the author that, in spite of the comparatively large amount of work and data reported, no consistent picture of the oxidation of plutonium yet exists.

The equilibrium diagrams of plutonium alloys given in Chap. 7 are remarkably clear, and their size is large enough to allow temperature or concentration determination with reasonable accuracy.

Authors and editors must be thanked for having adopted the same scale for concentrations and simply related scales for temperatures; comparisons and measurements are greatly facilitated by this convention. However, where several authors have published different data for the same system, only one diagram is shown in this handbook, and the disagreement between authors is indicated in the text. Discrepancies might have been made clearer by drawing the different versions on the same diagram.

The metallography of plutonium constitutes a short chapter (9), which could have been joined to Chap. 10 because of its similarity.

The section devoted to laboratory techniques (Chap. 10) describes their application to plutonium metallurgy. Apart from some considerations of essential modifications to apparatus due to the corrosive and radioactive characteristics of plutonium, the description seems to be too detailed in classical metallurgical techniques. No mention is made of techniques, such as autoradiography or gamma counting, specifically related to plutonium.

After a short section devoted to chemical properties, the chemistry part of the book describes, in Chap. 12, the different compounds of plutonium. Extensive data on properties and preparation of these compounds are given, which leads to some duplication of Chap. 8 (plutonium refractory compounds) in the case of  $\text{PuO}_2$ ,  $\text{PuC}$ , and  $\text{PuN}$ . The last part of the book comprises plutonium solution chemistry including oxidation states, complexes, solvent extraction, and molten salt chemistry. It gives an excellent survey of the large amount of work performed in this field, with numerous references.

Finally, the success of this

*Plutonium Handbook* must be emphasized. It is, indeed, a unique reference book for plutonium workers. Authors and editors must be congratulated for the quality and the amount of work performed.

*François Sebilliau is Head of the Plutonium Fuel Department at France's Commissariat à l'Énergie Atomique. For the past ten years he has been involved in plutonium metallurgy, ceramics, and fuel development, especially for fast breeder reactors. Prior to joining CEA in 1957, he was a metallurgist with the Office National d'Études et Recherches Aérospatiales. His degrees are from École Centrale des Arts et Manufactures in 1947 and from the Université de Paris (Ingénieur Docteur 1956).*

#### TUTTI FRUTTI

*Title* Nuclear Research with Low Energy Accelerators  
*Editors* Jerry B. Marion and Douglas M. Van Patter  
*Publisher* Academic Press, 1967  
*Pages* xii + 515  
*Price* \$13.00  
*Reviewer* Edward der Mateosian

If ever the proceedings of a meeting have appeared in print under favorable conditions, this fortunate book is an example of such. The outstanding characteristic of both the Symposium on Nuclear Physics Research with Low Energy Accelerators and this book, which contains the proceedings of the symposium, is timeliness. One learns in the preface that the idea for a conference dealing in depth with current experimental research using low-energy accelerators (below 5 MeV) originated in the subcommittee on Nuclear Structure of the National Academy of Science-National Research Council with the hope of stimulating those who might be considering nuclear structure studies at their own institutes. This function is served admirably by this publication, not the least because of the promptness with which it has appeared in print, hardly six months

after the symposium itself took place.

The book is typical of most reports of meetings in that it contains a series of papers, 22 in fact, by individual authors each with his own style and effectiveness. The first paper, which deals with "The technique of the application of lithium-drifted germanium gamma-ray detectors," is unfortunately disappointing evidence that not all papers are of satisfactory calibre. It is too wordy, and too full of trivia through which one must sort before one finds significant information. The second paper is an example of the material that makes this a useful book. It is a paper on gamma-ray angular correlation studies and isobaric analog states presented by someone working in the field who is familiar with the motivation for this kind of work, the theoretical implication, and the status of the field in general. Much data are presented for illustrative purposes, much of which comes from original work of the author. Similar papers discuss electromagnetic lifetimes, lifetime measurements with bremsstrahlung, Mössbauer studies with Van de Graaff Accelerators, lithium-induced reactions, and other fields of research which are actively being studied around these machines.

Several papers review areas perhaps a little more theoretical in nature, such as shell model calculations of interest to the participants of the conference, theoretical problems related to the study of the intrinsic shapes of light nuclei, and (for those whose tastes might be way out), astrophysical problems

All this material is presented in a highly concentrated and terse style and is not of the best kind for the novice to study. It is suited for the expert who is interested in learning what people in associated fields are doing and for the individuals entrusted with the responsibility of suggesting programs of research at their institutions.

The book ends with an interesting summary of the conference in which a review of the subject matter is followed by an evaluation of the field of nuclear structure physics. The attractions of work in this field are described in somewhat glowing terms. The last sentence is "Our chosen field remains a cornucopia, the fruits of which are not only sweet to our own taste, but also to

others." If one does not fear the occasional taste of lemon, then one can happily taste of these fruits in this book.

*Edward der Mateosian, a Physicist at Brookhaven National Laboratory since 1949, has been engaged in nuclear structure research since 1947. At present he is involved in an experiment designed to investigate double beta decay. He holds BA and MA degrees from Columbia and was an assistant in physics at Indiana University.*

#### BOOK ANNOUNCEMENTS

Although the following will not be reviewed, they may be of interest to some of our readers:

*Pressure Vessel Design and Analysis*, M. B. Bickell and Carlos Ruiz, St. Martin's Press, Inc., 1968, xii + 578 pp, \$21.00  
*American Men of Science*, Vol. VI (St-Z), 11th ed., R. R. Bowker, 1967, x + 988, \$25.00  
*Preparation of Nuclear Fuels*, part XVIII, A. D. Tevebaugh and D. L. Keller, Eds., American Institute of Chemical Engineers, 1967, v + 169 pp, \$15.00 (\$4.00 AICE members)  
*Annual Review of Nuclear Science*, Emilio Segre, Ed., Annual Reviews, Inc., 1967, v + 546, \$8.50  
*American Men of Science*, suppl. IV, R. R. Bowker, 1968, x + 523, \$20.00

All of the remaining books were published by the International Atomic Agency:

*Nuclear Activation Techniques in the Life Sciences*, 1967, 709 pp, \$14.50  
*Containment and Siting of Nuclear Power Plants*, 1967, 818 pp, \$16.50  
*Assessment of Airborne Radioactivity*, 1967, 766 pp, \$15.50  
*Plutonium as a Reactor Fuel*, 1967, 858 pp, \$17.50  
*Isotope and Radiation Techniques in Soil Physics and Irrigation Studies*, 1967, 446 pp, \$9.00  
*Neutron Thermalization and Reactor Spectra*, 1968, Vol. I, 656 pp, \$13.50; Vol. II, 530 pp, \$11.00  
*Fuel Burn-up Predictions in Thermal Reactors*, 1968, 243 pp, \$5.00  
*Directory of Nuclear Reactors*, Vol. VII: Power Reactors, 1968, 326 pp, \$9.00