An appendix provides an interesting dating of the book. It gives for example the maximum energy of the electron linear accelerator "a few beV" (Stanford expects 10 to 15 beV) and for the "high voltage accelerator" a maximum energy "10 MeV" (tandem machines now operate in the vicinity of 20 MeV). The latter conservative number may possibly be consistent with the facts since the appendix also gives for the limitation on energy: "discharge." Perhaps this all comes out right if the modern, higher energy tandem machines are thus logically eliminated because they require the "discharge" of negative ions to produce their 20 or so MeV.

The book is intended for a wide audience and will be interesting to essentially non-technical persons who want to gain some feeling of what the accelerator business is about.

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About the Reviewer: E. Creutz worked on nuclear physics and materials problems on the Manhattan Project at Princeton, Chicago and Los Alamos. He was a member of the Steering Committee for the "Rochester Meetings" during those confused but exciting days when there were more big accelerators (including the one at Carnegie Tech whose design and construction he directed) than there were named kinds of mesons. After a period as scientist-at-large on the Sherwood Project, he became Director of the John Jay Hopkins Laboratory for Pure and Applied Science of General Atomic.

Uranium, Vol. 8, Metallurgy of the Rarer Metals. By J. H. Gittus. Butterworth's, Bethlehem, Md. 623 pp. $24.75.

This book is the latest member of a series concerning the less familiar metals published by Butterworth of London and edited by H. M. Finniston. The chosen format, a volume of modest size to include the vital information about the element from the location of the ores to the metallurgy of the important alloys, presents any author with a formidable task. The topic for this book, Uranium, is properly characterized as one of the rarer elements, but it is not one of the less familiar. The literature concerned with uranium is more extensive by factors than that for the other elements reviewed in this series. The required selection of the pertinent information from such a vast accumulation puts a great burden on the author of a relatively short review. Granting the difficulty of the task, this book on uranium by Gittus still does not completely measure up to what might have been expected. In some parts of the book the selection of the material to be emphasized is less than skillful, and there are many more errors than should be tolerated. In other parts of the book, the selection of material is good and the text is largely error free.

On the dust jacket, the publisher claims to have presented at the time of printing (1963) the most up-to-date work available on the topic of uranium, in a concise manner suitable for both the general reader and the specialist. However, from the references used in the book, it would appear that nothing of interest could be found in the literature after early 1960. In comparison, the work *Uranium Metallurgy* by W. D. Wilkinson published about a year earlier makes use of many more recent references.

In the first four chapters of Gittus' book, those on "Ores," "Detection Exploration and Mining," "Ore Concentration" and "Manufacture of Uranium Metal and Its Compounds," a style is used which can be confusing even to a specialist. These chapters are essentially the recitation of information from the literature in condensed form. The condensation process has resulted in sections which are often difficult to read. Abbreviations are used and then defined pages later. Processes are described and significant variables omitted. Too, many mistakes are present both in fact and in language. From chapter five on, the book is concerned with the metallurgical properties of uranium. There is a remarkable change in the style of the book with the introduction of the new subject matter. The selection of subject material is good. The text is clear and relatively easy to read even when complex topics are discussed. The author is obviously dealing here with information with which he is very familiar.

There is a very good discussion of the problems associated with the production of reactor fuel elements based on metallic uranium. Both the practical aspects of fuel element problems (the nature of the production processes, the equipment involved, the limitations of the product) and the theoretical aspects (the nature of the uranium crystal, the interrelation of this crystal with the processing and end use environments) are skillfully presented. There are good reviews of radiation damage in uranium and the corrosion of the metal under conditions which are of interest to reactor designers.

The alloys of uranium are discussed in an effective and concise manner. Phase diagrams are given and the metallurgical properties of the alloys

important to the nuclear reactor field are described from both the fabrication and application points-of-view.

This book has the special value of presenting the discussion of uranium technology from the vantage point of work in Great Britain. Because of this and the competence of the discussions of the metallurgy and production of metallic uranium for nuclear reactor fuel elements, this volume by Gittus can be recommended for the specialist in the nuclear reactor field.

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About the Reviewer: John M. Googin is actively engaged, at the Y-12 Plant in Oak Ridge, in the production of components for nuclear systems, including shields as well as fuel elements. He has had twenty years of experience in the chemistry and metallurgy of uranium and its alloys, as well as lithium, beryllium, boron, carbon, tungsten and thorium. He designed the first large-scale zirconium-hafnium separation plant.

Progress in Nuclear Energy, Series IV, "Technology, Engineering and Safety," Vol. 5. Edited by C. M. Nicholls. The Macmillan Company, New York (1963). 622 pp. $17.50.

This book consists of 18 review articles on selected topics in nuclear engineering, 13 prepared by British and five by American authors. Although some of these articles are less comprehensive in scope than the titles suggest, they are of excellent quality and constitute valuable additions to the literature. Comments on the individual articles follow.

"Methods of Measuring Temperature in Nuclear Reactors" fulfills a real need for the consolidation of information on this subject in one convenient reference. The author's emphasis on the effects of transmutation on thermocouple composition is particularly worthwhile.

"Steels for Gas-Cooled Reactor Pressure Vessels: A Review of British Practice" does an admirable job of presenting important facets of a complex subject in a limited number of words. Recent data might justify a more optimistic treatment of transition shifts produced by neutron irradiation than was possible at the time this article was written.

"Compatibility Problems in Fast Reactors" is a well written summary of compatibility problems in liquid Na and NaK. It contains no mention of lithium or of nonmetallic coolants for fast systems.

"Chemical Engineering Technology of Organic Cooled Nuclear Reactors" is a discussion of purification of organic coolants by distillation, adsorption, filtration, and degasification to remove products of radiolysis and pyrolysis. It is well organized and clearly presented in a form which should be easily followed by a chemical engineer having general knowledge of reactor technology.

"The Thermal Reactivity of Nuclear Grade Graphites to Oxygen" is an accurate and thorough review of the effects of graphite structure, chemical kinetics, gas diffusion, and irradiation on graphite oxidation in reactors. Although the safety aspects of the hazard of catastrophic oxidation are emphasized, the importance of slow oxidation over the reactor lifetime is given rather minor consideration.

"Transportation and Diffusion of Fission Products in Graphite" perhaps emphasizes too much theoretical models based on first principles and emphasizes too little prototypic in-reactor experiments. This may merely reflect the paucity of the latter data at the time of writing.

"Irradiation Damage in Beryllium Oxide" appears to be a good, comprehensive review of the subject matter as of the time of writing.

"Radiometric Techniques and Instrumentation for In-Line Process Monitoring" presents the basic principles of radiation measurement in excellent fashion. The status of process monitoring instrumentation in the U. K. appears to be covered very adequately. Additional information concerning operating experience and long-term reliability of the various in-cell monitors would have been useful to enable comparison with similar instrumentation in use in the U. S.

"The Separation of Plutonium Isotopes" is a readable, concise description of the electromagnetic method, covering both theory and application. Other possible methods of separation are not considered.

"Development of a Production Process for Radio-Krypton Recovery by Fractional Absorption" describes a design and pilot plant study of a carbon tetrachloride solvent extraction process for the recovery of krypton.

"The Preparation of UO_2-PuO_2 Powders for Nuclear Fuels" describes the work done at Harwell on the preparation of UO_2-PuO_2 powders by coprecipitation from aqueous solutions and on the determination of the properties of those powders. It is interesting and instructive.

"Gas-Solid Contacting" presents an excellent review of the fundamentals of gas-solid contacting and of work done in Britain and Europe on the