Selected Papers on New Techniques for Energy Conversion. Edited by SUMNER LEVINE. Dover, New York, 444 pp. $2.85 (paperback).

This is a collection of 37 papers published in the years 1954–1959, in the fields of thermoelectric, thermionic, photovoltaic, electrochemical, and fusion science and technology. The papers are generally classics by acknowledged leaders in the various fields. The edition furnished the reviewer was a 6 × 9 in. paperback; most of the original papers were reduced to this size, with the result that the print is so fine that the reviewer's eyes waned long before his interest.

At the beginning of the book, the editor briefly describes the fundamentals of various energy sources and direct conversion techniques. There follow, still by way of introduction, three articles, one each on thermoelectricity, fuel cells, and fusion which are reasonably complete yet written partially with the objective of being easy to comprehend. These are followed by sections of several papers each on thermoelectric methods, thermionic effects, photovoltaic effect, electrochemical effect, and fusion. The reader who is new to any of the fields covered will find in each case an excellent introduction to basic phenomena. There are in addition many papers which delve into specialized fields such as plasma and solid state physics. The articles are generally quite intensive, but should be within the grasp of most nuclear engineers.

While the papers themselves are outstanding the collection cannot be said to be balanced. Almost half the book is devoted to thermoelectric conversion. There are three papers on fusion, though fusion is more properly classified as an energy source than an energy conversion technique. Fission power devices are omitted, it being the editor's belief that the subject is well covered in standard works. In view of the bounty of energy conversion developments stemming from some of the advanced nuclear power concepts, the reviewer feels that this omission may be more justified by the unavailability of information at the time the compilation was assembled than by adequate coverage in standard works. Indeed, nuclear programs such as SNAP may have left their greatest marks in our history because they have forced us to review some of our long-established precepts of energy conversion technology.

Inevitably there is repetition in a compilation of this type; the reviewer noted presentation of the electron potential energy diagram in six of the seven papers on thermionic conversion. The compilation suffers only slightly from the fact that considerable progress has been made in all of these fields since original publication of the papers, because many of the papers are monuments which will stand for some time.

Despite some shortcomings, there is ample material both to provide good grounding for the student new to the field as well as good reading for the specialist.

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(About the Reviewer: Mr. Mela is currently manager of the Advanced Systems Department, Dynatech Corporation, Cambridge, Mass., and serves in addition as a consultant to several government agencies in the field of Nuclear Power and Propulsion. He was previously associated with the SNAP program at Atomics International and prior to this was with Nuclear Development Corporation of America (now United Nuclear), where he pioneered work on the Military Compact Reactor and participated in many other programs. He has made contributions in a number of phases of reactor technology, including shielding, reactor design, and power plant design.)

The Metal Plutonium. Edited by A. S. COFFINBERRY AND W. N. MINER. Univ. of Chicago Press, Chicago, 1961, 446 pp. $9.50.

The book *The Metal Plutonium* is an outgrowth of a two-day conference held at the World Metallurgical Congress meeting in Chicago during November, 1957. The editors encountered many delays in preparing the text, but took advantage of the situation to update a major portion of the text. In the introduction, A. S. Coffinberry reviews briefly the development of plutonium metallurgy both in the United States and abroad.

Part I of the text is an historical review and, in reading this part, one is deeply impressed with the excellent work of the early investigators and their pioneering spirit.

The discovery of plutonium, the first isolation, and the microscale preparation of metal are covered in the first three chapters. This early work, carried out by chemists, demonstrated the ingenious and original ideas of the investigators to develop the chemistry of producing pure metal. The ultra microbalance capable of weighing a microgram of material to 1% for example, was developed. During the period 1943–1945 metallurgists investigated properties of the new metal. In short, plutonium metallurgy was the most important, the most interesting, and the most dangerous of responsibilities of the Los Alamos metallurgists. The balance of the "historical review" in Part I covers the development of metallurgical studies at Los Alamos and Argonne in the United States, and studies in France, England, and Canada.

Emphasis is given to the glove box development and techniques for handling the highly toxic plutonium.

Part II of the book deals with physical metallurgy of plutonium and its alloys. The complete crystal structure information for the six phases of plutonium metal, as well as a discussion of the metallic radius of plutonium and the electronic configuration in heavy metals, are presented in the opening chapter.

The measurement techniques and the basic properties of plutonium metal are reported by the different investigators both in the United States and abroad. Of particular note is the chapter on "Sound-Velocity Measurements on Alpha-Phase Plutonium" by investigators at Los Alamos. An account of the extensive studies carried out at Los Alamos is presented in some detail. The development of mechanical and electronic techniques required for precision sound velocity determination consumed a major portion of the effort of these investigators.

The remaining chapters of Part II present the phase diagram studies of plutonium alloys at Harwell, Los Alamos, and the published Russian work. Systems of importance to reactor technology or the weapons program and systems of interest to their possible contribution to the knowledge of alloying behavior of transuranic series of elements constituted the alloy system studies. The discussion of the alloying behavior of plutonium with other elements is very well summarized by both the British and American investigators.

The phase diagram work of the Russians and the review

of the intermetallic compounds of plutonium are very well represented.

The remaining part of the book deals with plutonium as fuel in various reactor systems. The technology of developing and producing plutonium bearing fuel elements for various reactors is presented. The development and fabrication of plutonium aluminum alloy elements for the NRX and MTR reactors is well presented by the Canadian and American investigators.

The last three chapters are discussions of plutonium fuels for power reactors, liquid metal fuel reactors, fast power reactors, and the mixed oxide concept.

One can emphatically conclude from reading the book that excellent metallurgical investigation of plutonium metal was performed by all engaged in research and development of the new man-made element. The book stands as a tribute to these investigators.

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(About the Reviewer: James F. Schumar was associate director of Argonne National Laboratory from March 1946 to March 1959. He was responsible, in this post, for establishing the Plutonium Fabrication Facility there and was also involved in planning of the Fuels Technology Building. He has been active in research and development at Argonne for plutonium bearing fuel materials. After a term at General Atomic he is back at Argonne and is Chairman of the American Nuclear Society's interim group which is seeking to become the Materials Technology Division.)