receiving an increasing emphasis over technical feasibility in efforts to institute possible savings in the fuel cycle. Furthermore, significant economic advantages can be realized by carefully evaluated fuel cycles which necessarily include the recovery of fissionable material, and perhaps radioactive isotopes, from the spent fuel element. Aqueous and nonaqueous reprocessing methods are described, and the effect of fuel element composition on processing is discussed. Specific cost estimates for fuel reprocessing and the relation of reprocessing to power costs are also discussed.

The brief chapter on "Fluid Fuel Systems" (S. Isserow) introduces the reader to the major fluid fuel systems that have received consideration. Adequate references are included.

"Fuel Element Economics" (B. S. Old and D. P. Herron) is a subject of major importance to anyone associated with reactor technology, especially to those in the commercial reactor field. The authors effectively introduce the subject of economics to the fuel element metallurgist, designer, and fabricator.

The book has these appendixes: (1) Phase Diagrams, (2) Fuel Element Fabrication Facilites, and (3) a Glossary. The second of these appendixes may not be completely accurate owing to the dynamic nature of fuel element technology. However, this section of the book gives the reader an idea of the machinery and tools used in the manufacture of fuel elements.

It is felt that Kaufmann's book will be useful as a general reference and as a guide to introduce the student, designer, metallurgist, or manufacturer to the intricacies of fuel element fabrication. It is not the purpose of the book to provide all of the information required to become expert in the metallurgy and fabrication of fuel elements. Certain chapters are much more complete than others, and for these alone the book is worthwhile. The serious student or practitioner will want to examine reference material and investigate other sources of information on specific subjects. This practice is recommended since no book, regardless of how well it is written, is purely objective.

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Small and Medium Power Reactors, Proceedings of the Vienna Conference, September 1960. International Atomic Energy Agency, Vienna, 1961. Vol. I, 632 pp. $9.00. Vol. II, 453 pp., $7.00.

These two volumes present the complete text as well as the accompanying discussions of the sixty-four papers presented at the Conference on Small and Medium Power Reactors held in Vienna in September 1960 under the auspices of the International Atomic Energy Agency. Forty countries were represented by two hundred sixty delegates. The United States was the major contributor with twenty-seven papers out of the total.

By definition the Conference was limited to the consideration of power reactors up to 150,000 electrical kilowatts in size. While consideration was given to the application of power reactors in this size range, many of the reactors discussed are, in fact, reactor experiments or prototypes for reactors which are expected to have their economic applications in sizes beyond those considered at this Conference.

Out of the nine sessions four were devoted to the general review of reactor systems and specific reactor designs.

Of particular interest is the paper by U. M. Staebler of the U. S. AEC which gives a review of the development programs for nuclear power in the United States and presented the U. S. AEC's view of conducting research with relatively small experimental reactors and prototypes which would lead to better understanding of reactor technology. Other papers covered the AEC's small PWR and superheat programs and the U. S. Army's nuclear power program.

Heavy water moderated and cooled reactors were covered by papers from Canada, the United States, and Germany. There were several papers on pressurized water and boiling water reactors. Most of these were by U. S. authors, but there were also papers from Japan and Germany. Babcock & Wilcox presented a paper on the improvement of neutron economy and power distribution by utilizing mixtures of light and heavy water to control PWR Reactors by changing the reactor neutron spectrum.

There were a number of papers on the application of gas cooling to small and medium size power plants. This session included papers from France, United Kingdom, Germany and the United States. There was also an interesting session on the application of organic cooling to small and medium size power plants. The papers in this session were all from the United States.

There are a number of papers from the session on construction and operation which appear to be very useful. The papers are from the United Kingdom, the United States, and the USSR.

A combined session on safety, fuel cycles, and staffing contains several interesting papers and pointed toward many interesting developments in the over-all fuel cycle. As a result of technical reliability, simplification of built-in safety features to reduce costs was anticipated. Some concern was shown toward overstaffing of the nuclear power plants. The question of licensing reactor plants brought up an interesting discussion.

One paper of particular interest reported on the plutonium recycle project at Hanford and presented new material on fuel fabrication, particularly the cold swaging of UO-2 fuel elements in Zircalloy and a process involving high intensity vibrational compaction which is of particular interest for fuels containing plutonium.

The thirteen papers presented in the two sessions on cost evaluation and economics were an interesting blend of realism and speculation. It was emphasized that before making cost comparisons the ground rules should be carefully defined to justify comparative evaluation. Most of the studies show that nuclear power plants in the size range considered would cost at least fifty per cent more than conventional power plants with no sharp decrease anticipated in the near future. The important effect of the annual fixed charges on the comparison between conventional and nuclear plants is illustrated in several papers. The calculated conventional fuel costs which would be equaled by nuclear power were quite high in most cases. It was clear that considerable improvement along the lines anticipated in the cost of the over-all nuclear fuel cycle were essential along with improvements in the capital costs if reactors in this size range were to be competitive in most situations.

In the final session the economists evaluated theoretically the potential of nuclear power in underdeveloped countries. The difficulties of power supply in less well developed countries is dealt with in a survey paper by the UNO. Nuclear power was favored for remote areas where hydroelectric power has to be transmitted over long distances and there are no sources of indigenous fuel.

The International Atomic Energy Agency, the sponsors of this conference, are to be commended for arranging this technical exchange which should be a milestone in the development of small or medium power reactor technology. Taking an over-all view of the whole conference the competitive usefulness of medium power reactors seems to be limited and there is no firm assurance that the nuclear power from these reactors will become competitive with conventional power in the coming decade in any except special circumstances.

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"Materials Science and Technology for Advanced Applications." Edited by Donald R. Mash, Prentice-Hall, Englewood Cliffs, New Jersey, 1962. 767 pp., $12.

The Foreword to this book begins, "It is not often that technical papers delivered at a regional conference are published in book form." Evidence that this is probably a good idea is given by a look at this book.

Mr. Mash's master mishmash consists of unrelated materials, including everything from a pep talk on success (p. 639) and two poems (pp. 92, 93), to a few sound technical discussions of some materials problems. Apparently the papers presented by the contributors to the 1962 Golden Gate Metals Conference were simply bound up together with no attempt at correcting, editing, or interrelating. The only unifying theme is the often repeated reminder that we now live in something called the "Space Age," although the Foreword states the basic theme is, "Effective performance by the metallurgist and materials engineer in meeting their responsibilities in the Space Age can be sustained only if progress in materials technology is accompanied by an appreciation of current and planned engineering applications."

Topics included vary all the way from discussion of specific impulse values for various chemical rocket fuels through specific materials problems on the B-58, and from lubricants (in space, of course) to corrosion in liquid metal systems. Some authors have attempted to direct their papers to problems arising from a specific application such as ion propulsion, plasma propulsion, nuclear ramjets, nuclear rockets, supersonic aircraft, "space," or high frequency electron tubes, whereas others have done better by concentrating on somewhat more narrow but better defined topics such as columbium physical metallurgy, pyrolytic materials, and electron emission from single crystals. It is quite remarkable to find a sound technical article on physical metallurgy for example in the same volume which also contains what is essentially a Chamber of Commerce talk about a metal forming machine. It makes one wonder what the various speakers at this conference could have found to talk about in common at the social events, except perhaps the social events themselves.

Several papers contain some careless pseudo-technical language such as that in one on direct conversion, which speaks of the desirability of high conductivity "so that the current developed is not dissipated in resistance heating." The author of the article on high energy rate forming (naturally of "space age materials") seems to have discovered a vector form of energy for he speaks of an occurrence in which "the kinetic energy of both assemblies is equal and opposite." The article on high frequency electron tubes talks about "the Cerenkov scheme" without ever saying what this is unless it may be contained in the cryptic sentence of this section, "megavolt electronics underlying the Rebatron is a process of multiplication." Perhaps this is a new way in which the gostock distims the doshes or maybe it refers to a time when it was brillig in the wabe.

In the paper on materials for plasma propulsion, beryllium oxide is mentioned with the statement "present supply is apparently difficult, and forming is a specialty." This reviewer has a strong prejudice for always reminding people that beryllium oxide is highly toxic. Also it is not clear why the "difficulty" of the supply or of the forming is