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Book Review

Thermodynamics of Nuclear Materials, Proceedings of the Vienna Symposium, May 1962. International Atomic Energy Agency, Vienna, and International Publications, New York, 1962. 808 pp. $11.00.

The International Atomic Energy Agency has made an important contribution in organizing this symposium which dealt with the thermodynamics of materials of importance for high temperature nuclear power reactors. The results of fundamental studies of the thermodynamics of reactor materials have been slow to appear in the literature. Most of the material presented in the forty-six papers from nine countries represents new data which have not appeared before.

With the exception of five papers in Russian and one in French, all other papers are in English. Abstracts of each paper are given in English, Russian, French, and Spanish. The translations were apparently made by nontechnical persons. Thus "vapor pressure" in Russian is translated to "elasticity of steam" in English, but anyone with technical background will be able to decipher the correct meaning of the words used in the abstracts. The discussion between the author and the participants following each paper is presented in English in every instance.

Of the forty-six papers, twenty-five can be classified as experimental studies of equilibria between gaseous and condensed phases at high temperatures with eight of these dealing with vaporization of metal carbides and seven papers dealing with vaporization of metal oxides. Nine additional papers deal with calorimetric determinations of heat capacities and entropies or of enthalpies of formation of compounds of interest for nuclear technology. Only six papers would be classified as theoretical or general discussion papers. A group of nine papers is primarily directed toward metallic alloy systems.

The discussions following the papers are particularly useful in bringing up problems that were not often adequately covered in the papers. The participants apparently had available preprints of the papers before the meeting, but these were not always thoroughly studied as several of the papers presented results that are clearly in error due to experimental errors or errors in the treatment of the data which should have been examined in the discussions.

Without the stimulus of this conference, some of the experimental results would not have been published or would have been greatly delayed in publication because of their tentative or incomplete status. This is especially so for the data on the vaporization of the carbides where the results obtained on the same compounds by different investigators differ by large factors. It is clear that very serious experimental difficulties remain to be overcome before the data can be properly interpreted. The presentation of the very discordant results at this conference will focus attention on the difficulties that must be overcome, and comparison of the various papers will undoubtedly greatly hasten the ultimate correct understanding of the vaporization processes and the correct characterization of the thermodynamic properties of the actinide carbides which are so important in fixing the ultimate lifetimes of very high temperature nuclear reactors.

In contrast to the data for the carbides the thermodynamic data for the actinide oxides, sulfides, selenides, and tellurides and for the lanthanide oxides appear to be well established and the availability of these data together in one book makes these proceedings especially useful.

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(About the Reviewer: Leo Brewer is a Professor of Chemistry and Head of the Inorganic Materials Research Division of the Lawrence Radiation Laboratory, University of California, Berkeley. His work in the Plutonium Project of the Manhattan District at Berkeley on high temperature systems and compilations of thermodynamic data is summarized in Vols. 11B, 12B, 14B, 18, and 19B of the National Nuclear Energy Series. He and K. S. Pitzer have revised the classic first edition of Lewis and Randall's "Thermodynamics.")