PREFACE

REACTOR MATERIALS PERFORMANCE

Proceedings of an ANS Topical Meeting Cosponsored by the Richland Chapter of the American Nuclear Society and the Materials Science and Technology Division April 1972

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The Richland Chapter of the American Nuclear Society and the Materials Science and Technology Division cosponsored a Topical Meeting on Reactor Materials Performance. The objective of this meeting was to examine current knowledge of the effects of nuclear reactor environment on the performance of materials, emphasizing the formulation of descriptive models which could be incorporated into synergistic performance codes for use in design of components for fast and thermal reactors. The present technology is advancing rapidly on two fronts: materials behavior in thermal and fast reactor environments and design and performance analysis of reactor components that must operate under severe environment and stress conditions. The Conference was therefore organized to promote dialogue among the experts in these two areas of technology.

The papers in this issue of *Nuclear Technology* comprise the bulk of those presented at the Conference. They relate the latest technical information in the fields covered in each of five technical sessions:

1. fuel pin cladding
2. fuel performance
3. absorber materials
4. coolants
5. structural materials

Thomas F. Murley, Core Design Branch of the AEC's Division of Reactor Development and Technology, set the stage for the Conference by emphasizing the need for nuclear power generation to meet the forthcoming world energy requirements. He indicated that the full realization of commercial nuclear power generation requires the solution of materials problems coupled with full use of materials capabilities in design of plant components. Major uncertainties in materials behavior lie in the behavior of fuel and absorber materials operating at elevated temperature to high burnups and in the amount of irradiation-induced swelling and creep, mechanical behavior and wear, galling, and self-welding of cladding and structural materials.

These topics were subjected to detailed examination and discussion. The fuel pin cladding session, chaired by J. R. Weir, Oak Ridge National Laboratory (ORNL), included the latest technology of mathematical models for damage functions, swelling and creep, and the mechanical behavior of cladding materials. This session then provided input for Session II on fuel performance, chaired by J. L. Scott, ORNL. The papers from this session present the latest fuel performance analysis models used to predict the performance of fuel assemblies in advanced nuclear power reactor systems.

It was recognized that control materials technology lags that of fuel in several respects. As a consequence emphasis has been increased in developing data and models to be used in the design of LMFBR reactor plants. Session III, chaired by R. E. Dahl, Hanford Engineering Development

Laboratory, presented the latest U.S. technology on boron carbide absorber materials and its application to the successful design and operation of LMFBR plant safety systems. Session IV on coolants, led by K. E. Horton, U.S. Atomic Energy Commission, provided a base for understanding the performance of materials in reactor plants using sodium or water coolants. The last session chaired by L. E. Steele, Naval Research Laboratory, presented the latest information on the performance of structural materials, including creep, fatigue and fatigue crack growth, and their application to the design of elevated temperature components.

This Conference, held in Richland, Washington on April 23-26, 1972, was attended by 192 experts in fuels and materials technology and reactor design engineering. We believe that the papers contained in this issue will provide a meaningful source of study and reference to the nuclear community. Some of the remaining papers will appear in later issues of *Nuclear Technology*.