FOREWORD

SPECIAL ISSUE ON THE SYMPOSIUM ON RADIATION EFFECTS IN CERAMIC OXIDE AND NOVEL LWR FUELS

Guest Editors

PENG XU
Westinghouse Electric Company

TODD R. ALLEN
University of Wisconsin–Madison

This issue of *Nuclear Technology* features selected papers from the Symposium on Radiation Effects in Ceramic Oxide and Novel LWR Fuels, which was held during the March 2012 meeting of The Minerals, Metals, and Materials Society (TMS) in Orlando, Florida. The symposium was cosponsored by the Center for Materials Science of Nuclear Fuel, an Energy Frontier Research Center led by the Idaho National Laboratory (INL), and the TMS Nuclear Materials Committee. The symposium was divided into four sessions: experimental characterization of nonirradiated and irradiated ceramic oxide fuels, multiscale modeling and theoretical work on microstructure evolution under irradiation, effects of radiation on thermophysical and mechanical properties of ceramic oxide fuels, and fuel pellet–cladding interactions and novel LWR fuels.

Eight speakers who are experts in radiation damage studies and nuclear fuels were invited from Germany, France, Russia, and the United States. William Weber from The University of Tennessee kicked off the symposium by giving an invited talk on a comprehensive overview of radiation damage in UO_2. Various radiation damage mechanisms were reviewed, and the presented data were a result of research and development efforts over five decades. Terry Wiss from the Institute for Transuranium Elements in Germany also delivered a well-received presentation on the state-of-the-art knowledge and understanding of fission gas behavior and high-burnup structures in UO_2 and MOX fuel.

The symposium accepted 26 contributed talks from graduate students, postdocs, and professors at universities, scientists at national laboratories, and engineers in the nuclear industry. With emphasis on the advanced modeling and characterization tools in understanding fuel behaviors, the symposium not only provided a platform for these professionals to discuss both the advances and the lessons learned in their research and development but also fostered new collaborations in both academia and industry. In the end, the symposium received positive feedback from the speakers and the audience—one of them called this symposium a "stimulating" and "unique experience."

Out of the 34 presentations, five of them were selected and peer reviewed for publication in this special issue of *Nuclear Technology*. Two papers discuss radiation damage studies in the fuel surrogate material CeO_2 with complementary tools. Lingfeng He and coauthors from the University of Wisconsin–Madison and INL used advanced experimental tools such as a transmission electron microscope to examine the defect clusters and bubble formation in ion-irradiated CeO_2, while Dilpuneet Aidhy and coauthor Dieter Wolf from Argonne National Laboratory applied computational tools to interpret radiation damage and recovery using molecular dynamic models. On the same surrogate material (CeO_2), Karin Rudman and coauthors from Arizona State University and Los Alamos National Laboratory performed state-of-the-art three-dimensional microstructural characterization to reveal the effect of the processing conditions on grain boundary distributions, while her colleague Harn Chyi Lim employed microstructurally explicit multiphysics models to simulate intergranular mass transport, which is important to track fission products and their presence. The last paper was written by Bruno Michel and colleagues from CEA France, who offered an in-depth discussion on the most recent advances in their pellet-cladding interaction modeling and the development of the unified fuel performance code PLEIADES.

We believe that the selected papers provide the LWR fuel community with a timely update on LWR fuel research in these selected areas.