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Preface

Forward for special JNM issue on accident tolerant fuels for LWRs

For the U.S. nuclear industry, the safe, reliable and economic operation of the nation's nuclear power reactor fleet has always been a top priority. As a result, continual improvement of the technology, materials, and fuels used has remained central to the industry's success. Decades of research combined with continual operation have produced steady advancements in technology and yielded an extensive base of data, experience and knowledge on light water reactor (LWR) fuel performance under both normal and accident conditions. Thanks to efforts by the U.S. government, private companies, national laboratories, and universities, a variety of different technologies to optimize economic operation have been developed and deployed over time.

Today, one of the missions of the U.S. Department of Energy Office of Nuclear Energy (DOE-NE) is to develop nuclear fuels and claddings with enhanced accident tolerance. Following the Great East Japan Earthquake in 2011, with the resulting tsunami and subsequent damage to the Fukushima Daiichi nuclear power plant complex, enhancing the accident tolerance of LWRs became a topic of serious discussion in the United States. As a result of direction from the U.S. Congress, DOE-NE initiated the Enhanced Accident Tolerant Fuel Development program.

In the Department of Energy, the Fuel Cycle Research and Development Advanced Fuels Campaign has been given the responsibility to conduct research and development on enhanced accident tolerant fuels with the goal of irradiating a lead test assembly or lead test rod in a commercial reactor by 2022. The Advanced Fuels Campaign has defined a fuel as having enhanced accident tolerance if, in comparison with the standard UO_2-Zircaloy system currently used by the nuclear industry, it can tolerate loss of active cooling in the reactor core for a considerably longer time period (depending on the LWR system and accident scenario) while maintaining or improving fuel performance during normal operations and operational transients, as well as design-basis and beyond design-basis events.

The papers contained in this special issue of the Journal of Nuclear Materials are focused on specific aspects of accident tolerant fuel research and development that are currently underway. These papers present the early results of research and development activities undertaken by a variety of organizations engaged in the research, development, and assessment of accident tolerant fuels and material technologies. The research comprises results from evaluating incremental as well as substantial changes to both the nuclear fuel form itself and the material employed as the fuel cladding. The list of participating authors reflects international interest in the topic of accident tolerant fuels.

The United States Department of Energy has embarked on an aggressive schedule for development of enhanced accident tolerant LWR fuels. The goal of developing such a fuel system that can be deployed in the U.S. LWR fleet in the next 10–20 years supports the sustainability of clean nuclear power generation in the United States.

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