NEUP Nuclear Energy University Programs
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CFA-17-12976: Study of the Irradiation Behavior of Fast Reactor Mixed Oxide Annular Fuel with Modern Microstructural Characterization to Support Science Based Model Validation

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Program: NSUF-2

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ABSTRACT: The objective of this work is to grow the available database of postirradiation data available for annular mixed-oxide (MOX) fuel irradiated in fast spectrum reactors. The key samples for this work are pins from the FO-2 irradiation that was conducted at the Fast Flux Test Facility. These pins are currently located at the Idaho National Laboratory (INL) Hot Fuel Examination Facility (HFEF) hot-cell. The data collected in this project would be used to validate models currently being developed at the Japanese Atomic Energy Agency (JAEA) for fuel performance models that seek to simulate MOX fuel behavior and will be implemented in BISON. Currently, the available data for annular MOX fuel performance is limited in comparison to the solid MOX fuel data set. Annular MOX fuel is necessary for high burnup (20% fissions per heavy metal atoms [FIMA]) fuel applications and any developed fuel performance code needs the ability to simulate fuel accurately to these burnups and accurately at lower burnups as well. Pins from the FO-2 irradiations are a key examples of annular MOX irradiated to an intermediate burnup of approximately 6 to 7% FIMA. Comprehensive postirradiation examination (PIE) of annular fuel pins from FO-2 is needed to provide data for fuel performance codes.

This project will directly contribute to the understanding of fast reactor MOX fuel by providing an important data set for the development of future fuel performance models. This project will also create an enduring impact by providing a wide variety of samples at several different local burnup (fission density) and temperature conditions to the NSUF sample library. At the conclusion of this project, the prepared microscopy samples will enter the NSUF sample library where they will be available for future measurements that can support additional BISON model development, future MARMOT model development, and available for new techniques as they are developed for PIE.

The collaboration proposed in this project between the U.S. Department of Energy and the Japan Atomic Energy Agency is already established by the current U.S.-Japan Civil Nuclear Working Group Advanced Fuels collaboration. This project would be a high profile portion of this already successful collaboration.