
Facilitating MARMOT Modeling of Radiation Phenomena in U-Pu-Zr fuels through experiments (MORPH)

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ABSTRACT:

The objectives of this proposal are to increase fundamental understanding of irradiation-induced metallic U-Pu-Zr fuel behavior and to obtain data needed for the development of irradiation models for metallic fuels in MARMOT. To achieve the project objectives, the principal investigators (PIs) request access to postirradiation examination (PIE) facilities at a Nuclear Science User Facility (NSUF) partner facility to conduct examination of irradiated metallic fuels. The requested metallic fuel is from the X-441 experiment irradiated in Experimental Breeder Reactor (EBR)-II and will be provided to the PIs by Nuclear Technology Research and Development (NTRD) program for the duration of the experiment. The purpose of the pins irradiated in the X-441 assembly was to vary Zr composition and fuel slug diameter in order to provide data for the metallic fuel performance code “LIFEMETAL” [ANL-IFR-125]. The fuels of interest to this project are metallic fuels with several Zr compositions (in wt.%): U-19Pu-6Zr, U-19Pu-10Zr, and U-19Pu-14Zr, which were irradiated to a peak burnup of ~11 at.%. The cladding was the same for all three fuel pins (austenitic stainless steel D9), which allows investigation of fuel-cladding interaction (FCI) phenomena. Varying Zr content in fuel pins enables investigation of the effect of Zr on fuel restructuring and fuel-cladding compatibility. Multi-scale PIE activities will be focused on the investigation of fundamental aspects of fuel performance such as species diffusion and migration, fission product behavior, and constituent redistribution. Obtained microstructural information will be used as the basis for the development of MARMOT models of U-Pu-Zr fuel performance at the mesoscale.