Focused Ion Beam for Advanced Specimen Preparation, 3D Microstructural Characterization, and Simulated Irradiation

Applicant Name: Utah State University

Project Director/Principal Investigator: Nicholas Roberts, Assistant Professor

Major Participants: Heng Ban, Professor; Ryan Berke, Assistant Professor; John Shervais, Professor; and Elizabeth Vargis, Assistant Professor

ABSTRACT:

The goal of this project is to acquire a Focused Ion Beam (FIB) instrument to strengthen core capabilities in advanced specimen preparation and materials characterization at Utah State University (USU). Specifically, the FIB instrument will be used to develop techniques for specimen preparation for thermophysical and mechanical property measurements that improve accuracy and eliminate the need for hot cell facilities. Additionally, the FIB instrument will be used to accelerate nuclear materials research at USU by simulating neutron irradiation with heavy ions and to perform post-irradiation 3D microstructural characterization. Finally, by combining all of these capabilities enabled by the FIB instrument, researchers at USU will be able to develop and validate models based on fundamental relationships between irradiation dose, microstructure, and thermophysical and mechanical properties. This instrument will also complement equipment and on-going activities at Idaho National Lab and other DOE facilities. The PI is uniquely qualified to carry out the project through extensive research experience with FIB processing and microscopy. His co-Investigators have leading expertise in materials and nuclear materials research, with current and prior funding through multiple DOE and other federal nuclear-related programs including VHTR (NGNP), FCR&D, ATR NSUF, NNSA, and NEUP. The equipment will also be instrumental in USU's future NEUP proposals beginning as early as FY18.

Nuclear Science and Engineering (NS&E) is a major research thrust area at USU. USU is the nearest doctoral-granting institution in either Mechanical or Aerospace Engineering to INL. Recognizing USU's rapid growth as a regional leader in NS&E research the USU Board of Trustees and the Utah Higher Education Board of Regents approved the establishment of a Nuclear Engineering Research Center (NERC) at USU in 2012. Many USU engineering faculty members are active in nuclear energy R&D in materials related topics, and their research will directly benefit from the proposed FIB instrument. The equipment will also attract and train undergraduate and graduate students to NS&E research and training at USU. The FIB instrument will be part of an initiative of establishing a nuclear materials and engineering emphasis area within the mechanical engineering curriculum at USU. The academic department, college, and university all support the endeavor and are committed to support the effort.