Full-Field Temperature and Strain Measurements at Extreme Temperatures

Applicant Name: Utah State University

Project Director/Principal Investigator: Ryan Berke, Assistant Professor
Major Participants: Heng Ban, Professor; Thomas Fronk, Associate Professor; Nick Roberts, Assistant Professor; and Ling Liu, Assistant Professor

ABSTRACT:

The goal of this project is to purchase key equipment to strengthen core capabilities in high temperature materials characterization at Utah State University (USU). Specifically, a multi-camera system consisting of infrared (IR), ultraviolet (UV), and visible-range cameras will be used to collect simultaneous full-field temperature and strain measurements from the surface of thermo-mechanically loaded nuclear materials. The equipment will fill a key infrastructure gap that will enhance research closely aligned with, yet complimentary to, DOE and INL programs. The measurements obtained using the equipment will be used to study heterogeneous mechanical phenomena such as fracture, fatigue, and creep at extreme temperatures, which in turn will be used to improve the safety, reliability, and performance of current and future reactor designs. Once operational, the system will be capable of performing some of the highest temperature measurements of its kind. The PI is uniquely qualified to carry out the project, having recently served as the primary developer and sole user of a similar system at the University of Illinois, Urbana-Champaign. His co-Investigators have leading expertise in nuclear materials research, with current and prior funding through federal nuclear-related programs including VHTR (NGNP), FCR&D, ATR NSUF, NNSA, and NEUP. The equipment will also be instrumental in the PI's future NEUP proposals beginning as early as next fiscal year.

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 equipment. The equipment will also attract and train undergraduate and graduate students to NS&E research and training at USU. The equipment from this project will be part of an overall effort establishing a nuclear 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.