Nuclear Engineering Teaching and Research Facilities Upgrade at the University of Illinois at Urbana-Champaign

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ABSTRACT:

The objective of this project is to enhance the teaching and research activities in NPRE for analysis of advanced materials and radiation detection for nuclear systems applications. These facilities will provide efficient mechanisms for studying mechanical properties and corrosion response in nuclear fuel cladding and structural materials under extreme environmental conditions, including high temperatures, high applied stresses, cyclic stresses, adverse environments and characterization of irradiation environments for future research and classroom experiments. These facilities will have a high impact on our research and teaching missions and build on existing experimental capabilities which are described below.

The proposal focuses on the description of the development of facilities for the creep, fatigue and corrosion of reactor materials at different value of pressure, temperature and exposure environment. One of these facilities is a system that is developed to directly study creep-fatigue-environment interactions using several individual pieces of equipment purchased under this program. This equipment is assembled to develop an automated pressure control system for specialized specimen loading at high temperature under aggressive environmental conditions. Another of these facilities is to establishing an in situ steam exposure capability on the UIUC FS MRL ETEM in order to enable us to observe the response of Zr-based LWR cladding to steam at temperature associated with design-based accident scenarios (1204˚C) and temperatures associated with beyond designed based accident scenarios (greater than 1204˚C). The report also provides also a summary of the cost of the facility.

These objectives will be accomplished through the purchase of a steam generator system for the ETEM facility, a supercooled neutron detector facility, and components to construct two creep-fatigue-environment testing facilities. The construction of the latter facility will be based on current successful designs used for other ongoing nuclear materials research and teaching activities.