DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-18-073

SECTION A. Project Title: Microstructure-Based Benchmarking for Nano/Microscale Tension and Ductility Testing of Irradiated Steels – Purdue University

SECTION B. Project Description

Purdue University, in collaboration with Oak Ridge National Laboratory (ORNL), proposes to develop standardized methods for nano/micro-scale tensile and ductility testing of irradiated Fe-Cr steels, through microstructure-based benchmarking. This project utilizes a multiscale, integrated feedback loop between models and experiments, to ascertain the effects of key experiment parameters on mechanical properties. Irradiated microstructure is used to inform finite element and dislocation dynamics models, which are then used to respectively design and interpret the macro-scale and nano/micro-scale tensile and ductility tests.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – Tensile testing of neutron-irradiated metallic alloys will be conducted, which will be shipped from the High Flux Isotope Reactor (HFIR, where they are being irradiated) to the ORNL hot cells (where they are being tested). Sections of test specimens will subsequently be shipped to ORNL Low Activation Materials Development and Analysis (LAMDA) facility, where they will undergo nano/micro-scale testing. Three specimens, each with a volume of ~0.77 mm^3, will be shipped from HFIR to the hot cells; the three specimens that will be shipped from the hot cells to LAMDA will each have a volume ~0.385 mm^3. ORNL already has established procedures in place for handling these quantities of radioactive material. After completion of this project, specimens will be returned to HFIR for long-term storage and availability to the scientific community via the Nuclear Science User Facilities (NSUF) Materials & Fuels database.

Radioactive Waste Generation – Radioactive waste will be generated at ORNL during the performance of the work effort. Specifically, debris could be generated during the macro-scale tensile testing, along with contaminated fixture tooling. The ORNL hot cell facility has extensive experience handling and disposing of this type of radioactive waste. All work will be performed to ORNL hot cell facility site-specific procedures and regulatory guidelines.

Mixed Waste Generation – Mixed waste may be generated at the ORNL hot cell facility and LAMDA facility. Both of these facilities have extensive expertise handling and disposing of this type of mixed waste. All work will be performed to these facilities' site-specific procedures and regulatory guidelines. All work will be supervised by the ORNL Environmental Health & Safety team and the facilities' respective safety officer.

Chemical Use/Storage – Chemicals will be used at Purdue University during the performance of the work in order to prepare specimens for metallographic examination. Cleaning solvents and electropolishing etchants will also be used. The laboratory has existing safety and handling procedures in place, including standard operating procedures (SOPs) for electropolishing, etching, and chemical disposal.

Chemical Waste Disposal – Any chemical waste from solvents, eletropolishing, or etching solutions, generated by the laboratory, will disposed of in accordance with SOP guidelines established by the laboratory and approved by the Purdue University Radiation & Environmental Management Group.

SECTION D. Determine the Level of Environmental Review (or Documentation) and Reference(s): Identify the applicable categorical exclusion from 10 CFR 1021, Appendix B, give the appropriate justification, and the approval date.

Note: For Categorical Exclusions (CXs) the proposed action must not: 1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, including requirements of DOE orders; 2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities; 3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; 4) adversely affect environmentally sensitive resources. In addition, no extraordinary circumstances related to the proposal exist which would affect the significance of the action, and the action is not "connected" nor "related" (40 CFR 1508.25(a)(1) and (2), respectively) to other actions with potentially or cumulatively significant impacts.

References: B3.6 Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial development.

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B3.10 Siting, construction, modification, operation, and decommissioning of particle accelerators, including electron beam accelerators, with primary beam energy less than approximately 100 million electron volts (MeV) and average beam power less than approximately 250 kilowatts (kW), and associated beamlines, storage rings, colliders, and detectors, for research and medical purposes (such as proton therapy), and isotope production, within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible), or internal modification of any accelerator facility regardless of energy, that does not increase primary beam energy or current. In cases where the beam energy exceeds 100MeV, the average beam power must be less than 250 kW, so as not to exceed an average current of 2.5 milliamperes (mA).

Justification: The activity consists of university-scale research activities aimed at developing standardized methods for nano/micro-scale tensile and ductility testing of irradiated Fe-Cr steels.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act) ☐ Yes ☒ No

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on 08/03/2018