

SECTION A. Project Title: Machine Learning on High-Throughput Databases of Irradiation Response and Corrosion Properties of Selected Compositionally Complex Alloys for Structural Nuclear Materials**SECTION B. Project Description**

The University of Wisconsin-Madison (UW), proposes to develop understanding and predictive models for irradiation response and corrosion properties of selected structural compositionally complex alloys relevant for high temperature nuclear applications. The project will utilize in-situ alloying with directed energy deposition additive manufacturing. Irradiation effects in materials will be studied with high-throughput ion irradiations. High-throughput oxidation vs. time and temperature for many samples will be made by exposing partially masked plates to high-temperature air conditions. Characterization of irradiated and corroded will include very rapid high-throughput characterization methods of nanoindentation (for hardening), profilometry (for swelling), plasma focused ion beam trenches for electron backscatter diffraction/energy dispersion spectroscopy/3D-slicing and x-ray diffraction. Addition lower-throughput characterization will also be used to validate and interpret the high-throughput method results, including accelerated characterization methods based on automated electron microscopy, as well as selected detailed characterization with atom probe and transmission electron microscopy.

SECTION C. Environmental Aspects / Potential Sources of Impact

Chemical Use/Store, Chemical Waste Disposal: The project will generate nonhazardous waste resulting from fabrication. This includes scrap metal, cleaning solutions, and other refuse. Waste that cannot be recycled will be disposed through the University Waste Disposal program. All storage of chemicals and materials are in approved storage containers and cabinets.

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.

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 to develop understanding and predictive models for irradiation response and corrosion properties of selected structural compositionally complex alloys.

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 8/10/2020