

SECTION A. Project Title: In-Situ Ion Irradiation to Add Irradiation Assisted Grain Growth to the MARMOT Tool – Pennsylvania State University
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SECTION B. Project Description

Pennsylvania State University proposes to experimentally investigate the effects of irradiation on grain growth of UO_2 at various conditions and as a function of grain size. The impacts of isothermal annealing temperature and irradiation on grain growth kinetics will be quantified in thin-film UO_2 TEM samples using in-situ techniques. The experimental data will then be used to validate simulations run using MARMOT, and the effects of irradiation on grain growth will be assessed for light water reactors using the expanded MARMOT capabilities. Experimental work will include production of nano-grained UO_2 TEM samples, characterization of these samples, and in-situ TEM ion irradiation experiments to investigate the influence of irradiation on UO_2 grain growth.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – The project will create uranium dioxide samples for irradiation in the IVEM. Such samples will consist of thin films (0.1 micron thick) deposited on salt which can be dissolved so that the thin film would float on deionized water and can be captured by a 3 mm sandwich type grid, which would encapsulate the film and constitute the specimen. Depleted uranium will be used for the fabrication of the sample and due to the small volume ($<0.1 \text{ mm}^3$), the sample radioactivity will be exceedingly small. Since the sample will be solid there is little risk of contamination. All the precautions imposed by health physics on campus will be applied to this sample fabrication.

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 aimed at investigating the effects of grain growth of UO_2 using ion irradiation.

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 06/29/2017