

**SECTION A. Project Title: Targeted Materials Characterization and Testing of Additively Manufactured Metals and Ceramics to Inform Print/Build Data Analytics – University of Texas at San Antonio****SECTION B. Project Description**

The University of Texas at San Antonio (UTSA) proposes a multifaceted approach to high throughput and robust materials characterization and testing to relate additive manufacturing (AM) print parameters, print orientation, and sample thermal histories to relevant nuclear reactor performance properties. Specifically, the team will perform high temperature steam oxidation testing characteristic of steam ingress from a depressurized loss of coolant accident in either a light water reactor (LWR) or an advanced gas reactor (AGR) within a steam secondary cycle. This type of data is not currently available for data analytics efforts of AM parts, though it is essential for reactor structural material qualification. The steam oxidation performance data sets will be complemented by micromechanical and phase composition characterization. The characterization and testing data acquired under the funded program will be used to inform high fidelity machine learning algorithms and data analytics developed and maintained at the ORNL as part of the Department of Energy Transformational Challenge Reactor program (TCR). Specifically, this collaboration aims to: 1) Work with TCR program personnel to identify, design, and produce strategic sample geometries; 2) Maintain an NQA-1 level quality assurance program in labeling, segmenting, testing, and tracking of precisely identified samples correlated to accurate build location and orientation; 3) Provide spatially correlated steam oxidation performance data in addition to micromechanical and composition characterization correlated to build location (point or volume) with a  $\pm 50$  micron accuracy; and 4) Develop in-house data analytics tool sets and collaboratively progress predictive and prescriptive AI algorithms with the TCR program to discover build-performance insights through the data sets. The proposed project will consist of the following tasks: 1) Design and receive sample sets from TCR; 2) Sample segmentation, labeling, and tracking; 3) Carbon and oxygen analysis of precursor powders and as-printed samples; 4) Steam oxidation of sample coupons; 5) Micro indentation; and 6) Data analytics.

**SECTION C. Environmental Aspects / Potential Sources of Impact**

The university (and its partner university) has procedures in place to handle any waste that will be generated through this project. The action would not create additional environmental impacts above those already occurring at the universities.

**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). For purposes of this category, “demonstration actions” means actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment. Demonstration actions frequently follow research and development and pilot projects that are directed at establishing proof of concept.

Justification: The activity consists of an investigation to supply materials characterization and testing data sets on additively manufactured core materials to be produced and leveraged by the TCR program to inform build/print data analytics methods.

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

Approved by Jason Anderson, DOE-ID NEPA Compliance Officer, on 09/17/2021.