

U.S. DEPARTMENT OF ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
NEPA DETERMINATION



RECIPIENT: West Virginia University Research Corporation on behalf of WVU

STATE: WV

PROJECT TITLE : HIGH-ENTROPY ALLOY-BASED COATING TO PROTECT CRITICAL COMPONENTS IN HYDROGEN TURBINE POWER SYSTEM

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0002553	DE-EE0010214	GFO-0010214-001	GO10214

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Policy 451.1), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:

Description:

A9 Information gathering, analysis, and dissemination Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.)

B3.6 Small-scale research and development, laboratory operations, and pilot projects Siting, construction, modification, operation, and decommissioning of facilities for smallscale 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 deployment.

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to the West Virginia University Research Corporation (WVU) for the design, fabrication, and testing of high-entropy alloys (HEAs), which are alloys formed using five or more elements. The HEAs would be integrated with thermal barrier coatings that would be used to protect important elements inside hydrogen turbine power systems.

Proposed project activities would include laboratory scale research. All proposed work would take place over three Budget Periods (BPs) and would be completed in existing, purpose-built facilities.

Proposed project activities would occur at WVU (Morgantown, WV), including the mechanical and physical testing of HEAs and HEA coatings, as well as oxidation and corrosion resistance. Praxair Surface Technology (PST) (Indianapolis, IN) would prepare and test HEAs and their coatings. The National Energy Technology Laboratory (NETL) (Albany, OR) would design and fabricate the HEAs, including computational design and manufacturing of HEAs using existing equipment.

BP1 activities would include the computational design and validation of the HEAs, preparing and manufacturing the HEAs and performing a wide variety of tests, including room-temperature and high-temperature tensile strength testing, thermal expansion testing, oxidation testing, and purity and density testing.

BP2 activities would include optimization of the designs and products from BP1; evaluating HEAs for composition, hardness, mechanical properties, structure, and ease of fabrication; and bulk manufacturing HEAs. BP2 would also commence with the development of HEA-based coatings by crushing the HEAs to a fine powder for use in thermal spray coating. Thermal fatigue resistance, oxidation testing, and corrosion testing would be carried out, followed by testing the compatibility of the HEA-based coatings and the thermal barrier coatings.

BP3 activities would include testing of the HEA thermal barrier coating system in a hydrogen combustion environment. A digital microscope would be used to see if there is a breakdown in the HEA system after testing. Lastly, techno-economic analyses would be carried out.

This project would include the handling of potentially hazardous materials including ethanol acetone, metal powders, argon, and sodium sulfate. All materials would be handled in the lab, which follows strict standards for handling

chemical waste, including proper disposal in accordance with Federal, state, and local regulations.

There are no physical modifications to existing facilities, no construction of new facilities, no ground disturbing activities, no changes in use of existing facilities, and no installation or deployment of outdoor equipment. There are no new permits or licenses required.

Any work proposed to be conducted at a federal facility may be subject to additional NEPA review by the cognizant federal official and must meet the applicable health and safety requirements of the facility.

NEPA PROVISION

DOE has made a final NEPA determination.

Notes:

Advanced Manufacturing Office (AMO)
Review completed by Alex Colling on 08/11/22.

FOR CATEGORICAL EXCLUSION DETERMINATIONS

The proposed action (or the part of the proposal defined in the Rationale above) fits within a class of actions that is listed in Appendix A or B to 10 CFR Part 1021, Subpart D. To fit within the classes of actions listed in 10 CFR Part 1021, Subpart D, Appendix B, a proposal must be one that would not: (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, or similar requirements of DOE or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities (including incinerators), but the proposal may include categorically excluded waste storage, disposal, recovery, or treatment actions or facilities; (3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that preexist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources, including, but not limited to, those listed in paragraph B(4) of 10 CFR Part 1021, Subpart D, Appendix B; (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species, unless the proposed activity would be contained or confined in a manner designed and operated to prevent unauthorized release into the environment and conducted in accordance with applicable requirements, such as those listed in paragraph B(5) of 10 CFR Part 1021, Subpart D, Appendix B.

There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal.

The proposed action has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)), and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

The proposed action is categorically excluded from further NEPA review.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature:

 Electronically Signed By: Casey Strickland

NEPA Compliance Officer

Date: 8/15/2022

FIELD OFFICE MANAGER DETERMINATION

- Field Office Manager review not required
 Field Office Manager review required

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature:

Field Office Manager

Date: