DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-19-133 R1

SECTION A. Project Title: Activities for Molten Salt Systems and Pyroprocessing Department

SECTION B. Project Description and Purpose:

Revision 2:

This revision includes addition of two tasks to the ongoing research activities performed at the Energy Innovation Laboratory (EIL) labs B208 and C213 under LI-654 and LI-784. (The original ECP incorrectly referenced LI-764.) The overall project goals are same as listed in original ECP:

1) The procurement, installation and operation of a water hydrogen torch. The torch is a benchtop system that splits an electrolyte solution into hydrogen and oxygen atoms. The torch will be used to flame seal quartz tubes and capillaries loaded with salt samples. Operation will include igniting the flame, sealing the tube containing salts and argon, and maintenace of the torch including refilling of methyl alcohol, flux, and electrolyte solutions. The salts to be handled will include chlorides and fluorides of Li, K, Mg, Zn, Na, Cs, Ca, etc. The sealed tubes maybe transferred to gamma irradiator located at EIL facility for irradiation of salt samples. The sealed tubes/capillaries will also be shipped to the collaborating labs for characterization including Brookhaven National Lab (BNL), Oak Ridge National Lab (ORNL) and University of Notre Dame (UND). The sealed tubes once shipped outside INL will not be returned to INL, and will be disposed of at the receiving site.

2) The purpose of this task is to investigate flowing salt properties. A natural circulation molten-salt flowloop equipped with instrumentation will be operated inside C213 glovebox, to analyze the molten salt flow characteristics (thermal gradients and flow dynamics). The corrosion samples of various metal/alloys will be introduced in the loop through the surge tank. Salt samples will be collected before, after and during the corrosion tests to monitor the metal alloy corrosion. Various techniques (i.e. ICP analysis, spectroscopy techniques etc.) will be used to perform analysis of salt samples collected during and after the measurement; and surface characterization techniques (SEM, FIB, optical microscopy etc.) will be used for analysis of metal/alloy surface after the corrosion test. In addition to the corrosion samples, a specimen of SS316 pipe will be characterized after the loop operation, to evaluate the corrosion during the operation. For salt and metal alloy characterization, the samples will be sent to labs outside EIL, to various facilities including INL Research Center, Center for Advanced Energy Studies, and Irradiated Materials Characterization Laboratory at the Materials and Fuels Complex. For some analysis techniques that might not be available at INL sites, X-ray photoelectron Spectroscopy (XPS) for example, the samples can be shipped to university collaborators.

Revision 1:

This revision includes the procurement, installation and operation of an off-the-shelf lab-scale glass and ceramic melter in the walk-in-hood in EIL C-213. Operation will involve the fabrication of small-scale glass and ceramic samples for testing and characterization involved with the Materials and Disposition Capabilities Program sponsored by DOE NA-22. The materials to be fabricated include $BSiO_4$ and $FePO_4$ glasses, and SiO_4, AlO_4, ZrO_4, TiO_2 ceramics. No hazardous constituents will be included in the formulations and off-gas from the fabrication will include water vapor and the above-mentioned constituents. Lab modifications will include adding a single-phase 208-volt outlet with 70 amps, using closed chiller or house water run to and from the furnace for cooling, and hookups for different atmospheres (already set up in the hood). Ventilation is also already set up, since this will be operated exclusively in the hood. Project goals are the same as those listed in the original EC.

Original ECP:

The objective of this program is to obtain fundamental data to support the development of molten salt systems, electrochemical separations, waste form production and development, and other technology development associated with missions and programs at the Idaho National Laboratory (INL) Energy Innovation Laboratory (EIL) using non-radioactive materials (cold testing).

Pyrochemistry and Molten Salt Systems department performs research and development activities with the specific goals of:

1. Determining fundamental physical and chemical properties of molten salt systems

2. Developing and implementing electrochemical separations

3. Performing chemical and physical measurements of various systems, such as: molten salts, metals, ceramics, glasses and other engineered systems.

4. Designing and conducting experiments on above mentioned systems.

5. Fabricating small-scale test specimens for experimental research.

Research toward the stated objectives is performed in the two labs located at the EIL: Lab B208 and Lab C213 using non-radioactive materials. The laboratory contains chemicals, equipment, and tools used in the preparation and experimentation of research activities such as sample preparation, powder preparation, electrochemical experiments, sample characterization, thermal property determination, and general chemistry methods. Some chemicals are sensitive to moisture and oxygen and are handled in inert (argon) atmosphere gloveboxes but all are listed on the 420.07 for LI-764.

Experimental samples will be prepared, processed, and characterized using equipment that is standard for the industry. This includes using instruments such as an autosiever, balance, cameras, differential scanning calorimeter (DSC), gloveboxes, hand tools, high or slow speed saws, high-temperature furnace, hot plate, impact mortar and pestle, Inductively coupled plasma mass spectrometry (ICP-MS), moister analyzer, laboratory glassware, laboratory oven, laboratory stirrer, micromill grinder, microscopes, microwave, pH/ion selective electrode meter, potentiostat, pycnometer, sonic sifter, spectroscopic analysis, thermogravimetric analyzer (TGA), vacuum pump, and other similar equipment.

Typical samples are under 5 kg for powders or solids. Liquid samples are also small and are typically one liter or less. Most characterization activities utilize smaller samples up to 200 g or 200 ml. Some samples will require heating and furnace temperatures typically between 500 - 650 deg C but up to 1200 deg C. Materials are procured, used, and stored in the laboratory. These materials include acids, powders, salts, and gases. A glovebox with HEPA filtered exhaust or fume hood with HEPA filtered exhaust is utilized as necessary. Activities may prepare mixtures with the composition desired for a given experiment or set of experiments. Typically, the process uses simple mixtures to focus on the partitioning of a specific compound. In other experiments, the process uses complex mixtures to imitate conditions expected during treatment of spent nuclear fuel. All materials used in this laboratory are non-radioactive and commercially available. Samples in secondary containers are labeled. Samples will be discarded when no longer needed.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

The processes may generate very small amounts of chemical emissions. These emissions are covered by APAD INL-13-007 R1.

Discharging to Surface-, Storm-, or Ground Water

N/A

Disturbing Cultural or Biological Resources

N/A

Generating and Managing Waste

Small amounts of common office trash are expected. Industrial waste such as boxes, plastic, and paper would be generated from packaging and office work. Some discharges of water may occur, if a closed-loop chiller is not used. It is anticipated that the samples will need to be disposed. WGS will assist in the characterization and management of any waste that is generated. Dilute acidic and basic solutions will be disposed off using SAA set up in lab B208.

Releasing Contaminants

Whenever chemicals are being used there is a potential for spills.

Using, Reusing, and Conserving Natural Resources

Project personnel would use every opportunity to recycle, reuse, and recover materials and divert waste from the landfill when possible.

SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification: Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

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, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not “connected” to other action actions (40 CFR 1508.25(a)(1) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

References:
10 CFR 1021 Appendix B3.6 "Small-scale research and development, laboratory operations, and pilot projects" and B1.31 "Installation or relocation of machinery and equipment.".

Justification:
The proposed R&D activity falls within the categorical exclusion, 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 deployment."

The equipment installation falls within the categorical exclusion, B1.31 "Installation or relocation and operation of machinery and equipment (including, but not limited to, laboratory equipment, electronic hardware, manufacturing machinery, maintenance equipment, and health and safety equipment), provided that uses of the installed or relocated items are consistent with the general missions of the receiving structure. Covered actions include modifications to an existing building, within or contiguous to a previously disturbed or developed area, that are necessary for equipment installation and relocation. Such modifications would not appreciably increase the footprint or height of the existing building or have the potential to cause significant changes to the type and magnitude of environmental impacts."

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: 01/06/2021