Project Title

Rare Earth Electrochemical Property Measurements and Phase Diagram Development in a Complex Molten Salt Mixture for Molten Salt Recycle

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Program: Fuel Cycle, FC-1.1: Electrochemical Separations

ABSTRACT:

A novel molten salt recycle approach was recently developed at the Argonne National Laboratory. The new approach has the potential of significantly reducing the complexity and cost of technology, proliferation risk, and processing waste generation. The rare earth (RE) drawdown by electrolysis is one of the key steps in which rare earths are separated from salt containing other active metal fission products. Investigation of RE electrolysis must consider the electrochemical properties of the REs relative to the other active fission products. However, little data has been reported on the complex mixtures of molten salts like those expected in a true, industrial-scale RE drawdown electrolysis process that contains both rare earths and other fission products such as cesium. We propose to conduct studies of detailed experiments and corresponding models to provide the data required to predict the electrochemical behavior of the rare earths in such a complex molten salt mixture so that the technological feasibility of the rare earth drawdown by electrolysis to enable molten salt recycling can be fully evaluated. The proposed research will be performed by RE electrochemical property measurement, phase diagram development and electrolysis model development. The proposed research directly addresses the NEUP topic FC1.1: Electrochemical Separations, which is supporting Fuel Cycle Research and Development (FCRD), whose goal is to develop "innovative methods to separate reusable fractions of used nuclear fuel (UNF) and manage the resulting wastes".

The proposed research will be led by The Ohio State University with two collaborating organizations (i) Argonne National Laboratory and (ii) University of Utah. The three PIs have many years of experience studying nuclear fuel pyroprocessing. The experiences and expertise of the three PIs are highly complementary. In addition, the three PIs are well acquainted from having worked together before under DOE-NE programs such as NEAMS and FCR&D. This expertise should be seen as invaluable in both ensuring the relevancy of the project and contributing to its successful execution.

This research is not directly related to any other DOE NEUP proposal for which the success of one project would depend on activities of the other project.