NUCLEAR ENERGY RESEARCH INITIATIVE

New Fission Product Waste Forms: Development and Characterization

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Collaborators: Sandia National Laboratories; Eltron Research, Inc.; Brigham Young University

Project Description

This project will outline advanced methods for the chemical partitioning of spent nuclear fuel into constituents (Cs, Sr, and minor actinides) that can be stored for future disposition. Researchers will study new waste forms and disposal strategies specific to the steam reforming process for the production of the Cs/Sr storage form with respect to the incorporation of Sr and Cs, their decay products, and rare earth fission products. A broad characterization study of inorganic ceramic waste form phases and the thermochemistry of these phases will provide a comprehensive data set from which to select the appropriate waste form. Emphasis will be on perovskite phases as a major constituent of the final waste form. The goal of this project is to reduce the costs associated with guanidinium carbonate steam reforming waste process, to minimize the risk of contamination to the environment during waste processing, and to provide DOE with technical solutions to a variety of issues related to Cs, Sr, and minor actinide disposal.

The proposed work will provide information on the durability and stability of these waste forms so that their potential for viable storage or disposal scenarios can be evaluated. The technical objective of this work is to 1) fully characterize the phase relationships, structures, and thermodynamic and kinetic stabilities of crystalline metal oxide based waste forms (e.g., perovskites) and 2) establish a sound technical basis for understanding key waste form properties, such as melting temperatures and aqueous durability, based on an in-depth understanding of waste form structures and thermochemistry. Since Cs and Sr form new elements by radioactive decay over several hundred years, researchers will study the behavior and thermodynamics of these waste forms using non-radioactive analogues.

Workscope

The team will focus on four research tasks that will provide the underpinning science necessary for establishing a steam reforming waste form, including:

- Phase identification and phase diagram determination
- Structure determination
- Thermochemical stability
- Structure-property relationships