

NUCLEAR ENERGY RESEARCH INITIATIVE

Chemistry of Transuranic Elements in Solvent Extraction Processes: Factors Controlling Redox Speciation of Plutonium and Neptunium in Extraction Separation Processes

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Collaborators: Argonne National
Laboratory

Project Description

The objective of this project is to examine the factors controlling redox speciation of plutonium and neptunium in UREX+ extraction in terms of redox potentials, redox mechanism, kinetics and thermodynamics.

Researchers will employ radiochemical redox-speciation extractions schemes in parallel to the redox experiment. The resulting distribution of redox species will be studied using spectroscopic, electrochemical, and spectro-electrochemistry methods. This work will result in creation of a database on redox stability and distribution of redox couples in the nitric acid/nitrate electrolyte and the development of redox buffers to stabilize the desired oxidation state of separated radionuclides. The effects of temperature and concentrations of acid and salt on the redox potential of actinide nitrate will be evaluated, considering a range of chemical matrix conditions. The database generated from the experimental work will be integrated into an existing actinide speciation code (AMUSE).

Workscope

This project consists of the following three primary tasks:

- Estimate the distribution of oxidation states of TRUs (Np, Pu, U) as a function of acid, nitrate, and temperature
- Determine redox reactivity of Np, Pu, U (and Tc) with studied oxidation/reduction agents and different conditions
- Model distribution ratios and develop database on redox buffering/separation factors