NUCLEAR ENERGY RESEARCH INITIATIVE

Advanced Aqueous Separation Systems for Actinide Partitioning

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Program Area: Advanced Fuel Cycle R&D

Collaborators:
Hunter College (CUNY)
Idaho National Laboratory
Lawrence Berkeley National Laboratory
Pacific Northwest National Laboratory
Tennessee Technological University
University of New Mexico
University of North Carolina, Wilmington

Project Description

One of the most challenging aspects of advanced processing of spent nuclear fuel is the need to isolate transplutonium actinides from fission product lanthanides. This project expands upon two existing approaches for partitioning americium (Am) from the lanthanides with the synthesis of new separations materials and development of radiochemical characterization. In the predominant trivalent oxidation state, the chemistry of these groups overlaps substantially and their mutual separation is quite challenging.

Two possible approaches with the greatest probability of success are: 1) application of complexing agents containing ligand donor atoms that are softer than oxygen (e.g., N, S, Cl-) and 2) changing the oxidation state of americium to IV, V, or VI to increase the essential chemistry differences relative to the lanthanides. A fundamental limitation of these approaches is that the softer donor atoms interact less strongly than does oxygen with the hard acid lanthanide and actinide cations (though slightly more so with actinides than lanthanides) thus necessitating specific, and perhaps unconventional, conditions for adequate phase transfer. Also, the upper oxidation states of Am are all moderately strong oxidants, so have limited stability in media that are representative of conventional aqueous separations systems.

The consortium will also develop a network of predominantly undergraduate universities whose students and professors will be invited to WSU for one-week tutorials on actinide science and the nuclear fuel cycle. This project seeks both to advance the scientific basis for nuclear fuels processing and to secure the workforce for continued operation of that sector.