NUCLEAR ENERGY UNIVERSITY PROGRAMS

Utilization of Methacrylates and Polymer Matrices for the Synthesis of Ion Specific Resins

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Project Number: 09-824

Initiative/Campaign: IIR

Abstract

Disposal, storage, and/or transmutation of actinides such as americium (Am) will require the development of specific separation schemes. Existing efforts focus on solvent extraction systems for achieving suitable separation of actinide from lanthanides. However, previous work has shown the feasibility of ion-imprinting polymer-based resins for use in ion-exchange-type separations with metal ion recognition. Phenolic-based resins have been shown to function well for Am-Eu separations, but these resins exhibited slow kinetics and difficulties in the imprinting process.

This project addresses the need for new and innovative methods for the selective separation of actinides through novel ion-imprinted resins. The project team will explore incorporation of metals into extended frameworks, including the possibility of 3D polymerized matrices that can serve as a solid-state template for specific resin preparation. For example, an anhydrous trivalent f-element chain can be formed directly from a metal carbonate, and methacrylic acid from water. From these simple coordination complexes, molecules of discrete size or shape can be formed via the utilization of coordinating ligands or by use of an anionic multi-ligand system incorporating methacrylate. Additionally, alkyl methyl methacrylates have been used successfully to create template nanospaces, which underscores their potential utility as 3D polymerized matrices. This evidence provides a unique route for the preparation of a specific metal ion template for the basis of ion-exchange separations. Such separations may prove to be excellent discriminators of metal ions, even between f-elements.