

# ***NUCLEAR ENERGY RESEARCH INITIATIVE***

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## **Plutonium Chemistry in the UREX+ Separation Processes**

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Project Number: 05-062

Collaborators: None

Related Program: AFCI

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### **Project Description**

The transmutation of long-lived radionuclides is being developed as a part of DOE's Advanced Fuel Cycle Initiative to address the disposal of commercial nuclear reactor fuel and to improve the performance of the geologic repository. This project will examine the chemical speciation of plutonium in UREX + (uranium/tributylphosphate) extraction processes for advanced fuel technology. Researchers will investigate the role of nitric acid and nitrates in plutonium separation and speciation. They will identify the plutonium species formed in aqueous and organic extraction phases and at the interface between phases, and will also determine plutonium distribution in each phase. This will allow a greater understanding of plutonium's extraction chemistry and enable the separation processes to be optimized.

### **Work Scope:**

Researchers will analyze the change in speciation using kinetic computer codes and existing thermodynamics to examine the speciation of plutonium in aqueous and organic phases. They will examine the different oxidation states of plutonium to find the distribution between the aqueous and organic phases under various conditions, such as different concentrations of nitric acid, total nitrates, or actinide ions. Other parameters that may affect plutonium speciation include pH levels, a range of oxidation-reduction (redox) potential, varying temperatures, and contact time.

The experimental procedures will be based mainly on radiochemical techniques and will focus on evaluating plutonium and uranium distribution as a function of conditions. Researchers will perform spectroscopic and radiochemical experiments on the actinides. They will also utilize techniques such as X-ray Absorbance Spectroscopy (XAFS) and Small-Angle Neutron Scattering (SANS) for determining plutonium and uranium speciation in all separation stages.