

NUCLEAR ENERGY UNIVERSITY PROGRAMS

Development of Alternative Technetium Waste Forms

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Abstract

The UREX+1 process is under consideration for the separation of transuranic elements from spent nuclear fuel. The first steps of this process extract the fission product technetium-99 (^{99}Tc) into an organic phase containing tributylphosphate together with uranium. Treatment of this stream requires the separation of Tc from U and placement into a suitable waste storage form. A potential candidate waste form involves immobilizing the Tc as an alloy with either excess metallic zirconium or stainless steel. Although Tc-Zr alloys seem to be promising waste forms, alternative materials must be investigated. Innovative studies related to the synthesis and behavior of a different class of Tc materials will increase the scientific knowledge related to development of Tc waste forms. These studies will also provide a better understanding of the behavior of ^{99}Tc in repository conditions.

A literature survey has selected promising alternative waste forms for further study: technetium metallic alloys, nitrides, oxides, sulfides, and pertechnetate salts. The goals of this project are to 1) synthesize and structurally characterize relevant technetium materials that may be considered as waste forms, 2) investigate material behavior in solution under different conditions of temperature, electrochemical potential, and radiation, and 3) predict the long-term behavior of these materials.