Synthesis and Characterization of Actinide Nitrides and Oxide Solid Solutions

G. W. Chinthaka Silva, Ph.D.
Department of Chemistry
University of Nevada, Las Vegas

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Synthesis of actinide nitrides and their oxide solid solutions were performed using a novel route developed at UNLV. In this method, actinide oxide was mixed with excess ammonium bifluoride to produce ammonium actinide fluorides. Heating the ammonium actinide fluorides under O\textsubscript{2}(g) and Ar(g) was utilized to synthesize the oxide solid solutions. The ammonium fluorides species were heated under NH\textsubscript{3}(g) to synthesize actinide nitrides. Evaluation of four different systems was completed for nitride synthesis using this method. The reaction mechanism and kinetics of UN\textsubscript{2} decomposition to UN were determined. Microscopy (SEM and TEM) was employed to characterize the resulting uranium nitrides. Synthesis and characterization of ThNF and Th\textsubscript{2}N\textsubscript{3} was also performed. A few new compounds were identified in the neptunium system. Among them, NpN\textsubscript{2} and Np\textsubscript{2}N\textsubscript{3} are important because only NpN was the only known nitride of neptunium up to now.

Figure 1. Unit cells of NpN\textsubscript{2} (left) and Np\textsubscript{2}N\textsubscript{3} compounds.