

Progress in Separations of Minor Actinides for Used Nuclear Fuel Recycle

Bruce A. Moyer
Corporate Fellow and Group Leader, Chemical Separations
Chemical Sciences Division
Oak Ridge National Laboratory

Wednesday, February 8
4:00 pm
Hill Hall 202

Abstract. Separation of minor actinides has been an active research area worldwide toward achieving a closed nuclear fuel cycle that reduces the heat and radiotoxicity burden on geologic repositories, reduces the consequences of potential disruptive events involving repositories, and increases the utilization of nuclear fuel. Simple and efficient americium and curium separations, from lanthanides and from each other, are regarded as major technical challenges requiring new technology. While research so far has produced demonstrated technologies for such separations, they have tended to be complex, difficult to control, and expensive. Needs for simpler chemistry, greater robustness to aggressive conditions, reduced waste production, and increased efficiency are widely recognized. The Sigma Team for Advanced Actinide Recycle (STAAR), an activity within the USDOE Fuel Cycle Technology program, has been developing new science and technology to achieve these goals, with particular focus on the problem of separating trivalent actinides from lanthanides. Accordingly, integrated hypothesis-driven research mainly within the paradigm of aqueous reprocessing of used oxide nuclear fuel dissolved in nitric acid is being pursued. Questions being addressed deal with principles of selectivity through various means including aqueous-phase complexation, soft-donor extractants, and exploiting high oxidation states of americium. Explicit attention is also paid to the question of robustness of chemical systems under conditions relevant to future technology implementation. This presentation reviews the technical need for minor actinide separation, STAAR scientific thrusts to address these needs, recent highlights of achievements, and future directions.

Biography. Bruce Moyer is a Corporate Fellow at Oak Ridge National Laboratory, specializing over a 37-year career in both fundamental and applied aspects of solvent extraction and ion exchange. He received his BS degree summa cum laude with chemistry honors from Duke University in 1974 and his PhD in inorganic chemistry from the University of North Carolina at Chapel Hill in 1979 under the direction of Prof. Thomas J. Meyer. In addition to his duties as Group Leader, Chemical Separations, in the ORNL Chemical Sciences Division, Dr. Moyer leads three programs for the US Department of Energy: Principles of Chemical Recognition and Transport in Extractive Separations (Office of Science), the Sigma Team for Advanced Actinide Recycle (Office of Nuclear Energy), and the Diversifying Supply Focus Area of the Critical Materials Institute, a USDOE Energy Innovation Hub. He has also provided leadership for the chemical development of the Caustic Side Solvent Extraction (CSSX) process for cesium removal from millions of gallons of legacy nuclear waste at Savannah River Site, which won the Secretary of Energy's Award in 2013. Dr. Moyer also serves as Co-editor of the journal *Solvent Extraction and Ion Exchange* and the book series *Ion Exchange and Solvent Extraction*.

