Minor actinide partitioning: main outcomes in the framework of the 2006 French act

Christine Rostaing, Christophe Poinssot, Dominique Warin, Pascal Baron, Nathalie Herlet
Commissariat à l'énergie atomique et aux énergies alternatives, Marcoule, France

Abstract

The Waste Management Act passed by the French Parliament on June 28, 2006, demands that Partitioning and Transmutation research are conducted in strong connection to GEN IV systems and ADS development, allowing to assess the industrial perspectives of such systems in 2012.

In this framework, the CEA had launched an important program which aimed at :

- developing different hydometallurgical processes for minor actinide separation depending on the scenario selected for the future nuclear cycle : homogeneous recycling (Pu, Np, Am, Cm) heterogeeneous (Am,Cm or Am alone) recycling,
- getting closer to process implementation conditions to assess industrial feasability of the various concepts developped.

Between 2007 and 2010, three concepts have been developped and validated in the Atalante facility through counter current hot tests implemented in mixer-settlers, using some hundred grams of spent fuel :

- GANEX for Grouped ActiNide Extraction is dedicated to homogenoeus recycling. It consists of two steps : the first step uses a monoamide extractant for the selective extraction of uranium. The second step is an adaptation of the DIAMEX-SANEX process. The solvent is a mixture of DMDOHEMA and HDEHP diluted in HTP. The transuranium elements (Pu, Np, Am, Cm) are coextracted with lanthanides and then selectively stripped with a polyaminocarboxylic acid (HEDTA for example) in a buffer medium at pH around 3.
- SANEX-TODGA is fitted for the heterogeneous recycling of Am+Cm in blankets put in the periphery of the reactor. The solvent is a mixture of TODGA (a diglycolamide) and TBP in http. After coextraction of An(III) and Ln(III), An(III) are selectiveley stripped with DTPA in a buffered malonic acid solution at pH 2.5.
- EXAm is adapted for Am alone recovery. The key is the extraction-scrubbing step : Am and light lanthanides are extracted while Cm and heavy lanthanides are recovered in the raffinate thanks to the diamide in the organic phase combining with a complexing agent (TEDGA) in the aqueous phase.

In the same time, studies have been conducted to assess industrial feasibility. The processes based on liquid-liquid extraction benefit from the experience gained by operating the PUREX process at the La Hague plant. Nevertheless, the processes present specificities which have been considered: evolution of the simulation codes, piloting of the processes, definition of the implementation conditions in continuous contactors; stability and solvent clean-up studies to

assess long term behavior of the separation systems towards radiolysis and hydrolysis, liquid waste management.

Significant results issuing from this research work are given.