

Ph.D. defense

Institut de Chimie Séparative de Marcoule / CEA Marcoule
(UMR 5257, CEA, CNRS, Université Montpellier, ENSCM)

ZIJUN LU

will present his Ph.D. dissertation

Multi-scale approach for understanding and optimization of uranium extraction from sulfuric media by nitrogenous amphiphiles

The defense will take place on **Monday, November 16th, 2020 at 10.00 am**
in the ICSM Auditorium

This thesis is dedicated to the understanding and optimization of the AMEX process applied for uranium extraction from sulfuric environment with a multi-scale approach considering both the chelation and the supramolecular self-assembly of the extractant molecules. AMEX process relies on amines extractants and requires the addition of phase modifiers as octanol to avoid the formation of a third phase. While broadly exploited, the structural mechanisms of tertiary amines and phase modifiers have never been investigated. This study revealed that octanol has little influence on extraction, but avoids the third phase formation by forming a shielding barrier around the aggregates that prevents from their coalescence. Considering the effect of tertiary amines alkyl chains configuration on their extraction and aggregation properties, we moreover demonstrated that tertiary amines with longer or slightly branched alkyl chains show better phase stability and maintain efficient uranium extraction. However, significant branching was shown to hinder the aggregation and any possible extraction. At last, we proposed a new solvent extraction system based on a mixture of trioctylammoniums ionic liquids. An unexpected synergistic combination of the SO_4^{2-} and NTf_2^- anions allowed not only to reduce the viscosity of the solution, but also to improve significantly the extraction of uranium. The investigation of the origin of this synergy showed that uranyl forms complex with three sulfates without involving directly the hydrophobic anion NTf_2^- . Interacting in a second coordination sphere, it was suggested that NTf_2^- consolidates the interaction between the ammonium cations and uranyl complexes, and increases the solubility of uranyl complexes in the organic phase thanks to its hydrophobicity.

Keywords: Uranium extraction; multi-scale characterization; third phase formation

