INTERNATIONAL NUCLEAR ENERGY RESEARCH INITIATIVE

Development of Computational Models for Pyrochemical Electrorefiners of Nuclear Waste Transmutation Systems

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Project Description

Electrorefiners are central elements in pyroprocessing technology and are currently used to treat driver and blanket fuels from the Experimental Breeder Reactor-II (EBR-II) at INL. Despite successful test results, the multi-dimensional computational models essential for design and operational analysis of advanced processors can be greatly improved. The currently available electrorefiner model, General Purpose Electrochemical Simulator (GPEC), suffers from severe limitations in predictive capability due to its extensive reliance on empirical parameters.

The goal of this project is to develop two multi-dimensional computational models in order to improve the operation of electrorefiners currently used in pyroprocessing technology. These 2-D and 3-D mathematical models will be based on the fundamental physical and chemical properties of the electrorefiner processes. Researchers will use the models to validate compiled and evaluated experimental data to provide better information for developing advanced electrorefiners for actinide recovery.

In this project, each organization will separately develop their computational models, then share data and work jointly to validate the models against experimental data sets. In the first phase, researchers will plan and assess a common computational platform for the modeling work and identify spatial characterization requirements. The second phase will focus on developing a 3-D electro-fluid dynamic model and a 2-D electrorefiner model. In the last phase, researchers will validate and benchmark the two models with compiled experimental data sets.