Contribution ID: **164** Type: **Verbal**

Electro-fluid analysis of a molten-salt electrorefiner for pyrochemical nuclear waste treatment

Pyrochemical technology have given us the capability to treat spent nuclear fuels and been acknowledged to have the proliferation-resistant principles. These processes could play on an important role in reducing the long-term hazards of a spent nuclear fuel by separating the uranium and transuranic actinides, which in turn may be transmuted in a fast breeder reactor.
The most effective way to accelerate the development of these technologies is to formulate physical models of the underlying electrochemical and transport processes. The multi-physics computational models can be essential for design and operational analysis of advanced processors and offer an efficient approach to implementing these processes.
In this study, the electrochemical principles and forced convection of molten eutectic (LiCl–KCl) electrolyte in a uranium electrorefining cell are considered to establish an appropriate electro-fluid model within the 3-dimensional framework of a conventional computational fluid dynamic model. Diffusional mass transport as a controlling step is modeled for the surface resistance of charge transfer between the electrode and molten-salt phase in which a constant composition is provided by an intense forced mixing of the bulk solution. The approach in this study is focused on the mass transport and current arising due to the concentration and the surface overpotential based on a cell configuration. This computational platform includes the electrochemical reaction rate of charge transfer kinetics which is described by a Butler–Volmer equation, while mass transport is considered using an ionic transport equation. The coupling of the local overpotential distribution and uranium concentration gradient makes it possible to predict the local current density distribution at the electrode surfaces.

Primary author: Dr KIM, K. R. (Korea Atomic Energy Research Institute)

Co-authors: Prof. PARK, B. G. (Soonchunhyang Univ.); Dr AHN, D. H. (Korea Atomic Energy Research Institute); Dr LEE, H. S. (Korea Atomic Energy Research Institute); Prof. HWANG, I. S. (Seoul National Univ.); Dr SHIM, J. B. (Korea Atomic Energy Research Institute); Prof. YI, K. W. (Seoul National Univ.); Dr KIM, S. H. (Korea Atomic Energy Research Institute); Dr PAEK, S. (Korea Atomic Energy Research Institute); Dr KWON, S. W. (Korea Atomic Energy Research Institute); Mr CHOI, S. Y. (Seoul National Univ.); Dr JUNG, Y. J. (Korea Atomic Energy Research Institute)

Presenter: Dr KIM, K. R. (Korea Atomic Energy Research Institute)

Track Classification: Chemistry of Nuclear Fuel Cycle, Radiochemical Problems in Nuclear Waste Management