Hunter B. Andrews, Dalsung Yoon, Seung H. Kim, Supathorn Phongikaroon

Virginia Commonwealth University

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Measurement and Analysis of Exchange Current Density of Lanthanides in LiCl-KCl Eutectic Salt

As nuclear power has continued to play a key role in the world's energy, used nuclear fuel (UNF) has become a larger concern for the nuclear industry. One of the pursued options for the treatment of UNF is pyroprocessing technology. This process uses a method of electrorefining in molten chlorine salt (mainly, LiCl-KCl eutectic) to potentially extract actinides and rare earths from UNF. While countless studies have been performed on the thermodynamic and electrochemical behavior of actinides and lanthanides in an electrorefiner environment, there is a lack of agreeable information on materials of interest, providing a motivation for this study. The objective of this work is to develop an experimental program for measurement and analysis of electrochemical properties of lanthanides (e.g. cerium, lanthanum, gadolinium , neodymium) in molten LiCl-KCl system, particularly the exchange current density i_0, through three methods: 1) cyclic voltammetry, 2) Tafel analysis, and 3) linear polarization.