

Electrochemical Impedance Spectroscopic Study on Eu^{2+} and Sr^{2+} Using Liquid Metal Cathodes in Molten Chlorides

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For the pyrochemical reprocessing of spent metallic nuclear fuels in molten salt baths it is important to investigate the behavior of the electrochemically negative elements Eu and Sr, which are significant fission products. Voltammetric and chronopotentiometric studies have shown that the reduction of Eu^{2+} and Sr^{2+} on liquid Pb cathodes in molten chloride baths at 1073 K follows the alloy formation reaction: $\text{Eu}^{2+} + 2e^- + 3\text{Pb} \rightarrow \text{EuPb}_3$ and $\text{Sr}^{2+} + 2e^- + 3\text{Pb} \rightarrow \text{SrPb}_3$. In the present work these alloy formation reactions were studied by electrochemical impedance spectroscopy. Analysis of the spectra showed that the electronic exchange of Eu^{2+}/Eu and Sr^{2+}/Sr is quasi-reversible. Moreover, the experimental results allowed the determination of the kinetic parameters of Eu^{2+}/Eu and Sr^{2+}/Sr , the diffusion coefficients of these species in molten chloride baths, and also the diffusion layer thickness.

Key words: Alloy Formation Reaction; Europium; Impedance; Liquid Metal Cathodes; Molten Salts; Strontium.