

Predominance Diagrams of Spent Nuclear Fuel Materials in LiCl-KCl and NaCl-KCl Molten Salt Eutectics

Rema Abdulaziz, Leon D. Brown, Douglas Inman, Stefaan Simons, Paul R. Shearing and Daniel J. L. Brett*

Electrochemical Innovation Lab, Department of Chemical Engineering, University College London, Torrington Place, London, WC1E 7JE, United Kingdom

*E-mail: d.brett@ucl.ac.uk

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Predominance phase diagrams for metal-molten salt systems are diagrams of potential vs. the negative logarithm of the activity of O^{2-} ions ($E-pO^{2-}$); they are a valuable tool for predicting and understanding electrochemical systems and for optimising process conditions. Here, predominance diagrams are produced for the range of nuclear spent materials (U, Pu, Np, Am, Cm, Cs, Nd, Sm, Eu, Gd, Mo, Tc, Ru, Rh, Ag and Cd species), in both LiCl-KCl at 500 °C and NaCl-KCl at 750 °C. The two salt eutectics were chosen as they are the two main systems used for pyroprocessing; temperatures were selected within each salts normal operating range. All of the diagrams presented show regions of stability for the different metal species, their oxides and chlorides at unit activity; however, this activity can be altered in accordance with the equations derived. Examples of selective electrochemical reduction are also demonstrated for potential spent fuel reprocessing in both salt systems.

Keywords: Predominance diagrams; Spent fuel; Nuclear materials; Molten salts; Pyroprocessing.

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