Electrochemical Behaviors of Cr(III) in Molten LiF-NaF-KF Eutectic

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The electrochemical properties and kinetics of chromium(III) in molten LiF-NaF-KF (46.5-11.5-42 mol %, FLiNaK) eutectic at 700 °C were studied by using cyclic voltammetry (CV) and square wave voltammetry (SWV). CV and SWV results indicate two steps of electron exchange process, corresponding to the reduction of Cr(III) to Cr(II) and Cr(II) to Cr(0) and the oxidation of Cr(0) to Cr(II) and Cr(II) to Cr(III). The redox of Cr(III)/Cr(II) is reversible, while the redox of Cr(II)/Cr(0) is quasi-reversible in the range of the scan rate investigated in this study. The reduction processes of Cr(III) to Cr(II) and Cr(II) to Cr(0) are diffusion-controlled according to the linear relationship between i_{pc} and the square root of scan rate (below 400 mV/s). The diffusion coefficients of Cr(III) and Cr(II) were calculated to be $(9.56 \pm 0.57) \times 10^{-7} \text{ cm}^2 \cdot \text{s}^{-1}$ and $(3.68 \pm 0.09) \times 10^{-6} \text{ cm}^2 \cdot \text{s}^{-1}$ at 700 °C, respectively. Also, the apparent standard potentials of Cr(III)/Cr(II) and Cr(II)/Cr(0) were estimated to be -0.215 V (vs. Pt) and -0.152 V (vs. Pt).

Keywords: Chromium; FLiNaK; Cyclic voltammetry; Square wave voltammetry

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