The Electrochemical Behavior of Cr(II) Ions in NaCl-KCl Melt

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The cathodic behavior of Cr (II) ions on Pt electrode in molten NaCl-KCl mixture at a temperature of 710 °C (983K) was investigated by cyclic voltammetry, square wave voltammetry, chronopotentiometry, and chronoamperometry. The results indicate the reduction process of Cr (II) to Cr on Pt electrode was one step: \( \text{Cr}^{2+} + 2e^- = \text{Cr} \). Reduction of Cr (II) ions is a quasi-reversible process controlled by diffusion mass transfer, and the reduction product is insoluble. The diffusion coefficient for chromium (II) ions in NaCl-KCl melt calculated by the data of cyclic voltammetry and chronopotentiometry, is \( 1.31 \times 10^{-5} \text{ cm}^2 \cdot \text{s}^{-1} \) and \( 1.15 \times 10^{-5} \text{ cm}^2 \cdot \text{s}^{-1} \), respectively. The growth process of Cr (II) ions on Pt electrode was instantaneous three-dimensional nucleation. Potentiostatic electrolysis performed on the Pt electrode confirmed the feasibility of electrodepositing metallic chromium in the molten NaCl-KCl-CrCl₂ system.

Keywords: molten salt; chromium; electrochemical behavior; diffusion coefficient; potentiostatic electrolysis

FULL TEXT

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