

The Electrochemical Reduction of Chromium Sesquioxide in Molten Calcium Chloride under Cathodic Potential Control

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Electrochemical polarization and reduction experiments are reported which were performed with a three-terminal cell and a molten salt electrolyte consisting of calcium chloride with additions of calcium oxide. Employing a metal cathode, a graphite anode and a pseudo-reference electrode also made from graphite, polarization measurements were carried out with the aim to validate the performance of the pseudo-reference electrode and to assess the stability of the electrolyte. Using a chromium sesquioxide cathode in conjunction with a graphite anode and a graphite pseudo-reference electrode, electrochemical reduction experiments were conducted under potentiostatic control. The key results are: a graphite pseudo-reference electrode has been shown to be appropriate in the present type of molten salt electrochemical experiments that take place on a time scale of many hours; the conversion of chromium oxide into chromium metal has been accomplished under cathodic potential control and in the absence of calcium metal deposition; a significant amount of calcium oxide in the calcium chloride has been found necessary to preclude anodic chlorine formation throughout the entire experiment; a considerable overpotential has been identified at the anode.

Key words: Electrochemical Reduction; Calcium Chloride; Chromium Sesquioxide; Chromium; Graphite; Reference Electrode; Anode Overpotential.