Electrochemical Evaluation of Titanium Production from Porous Ti₂O₃ in LiCl-KCl-Li₂O Eutectic Melt

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This work presents an electrochemical co-reduction of porous Ti₂O₃ in LiCl-KCl-Li₂O melt at 800 °C. Cyclic voltammetry was applied to investigate the electrochemical behavior of Li⁺, Cl⁻, O²⁻ and CO₃²⁻ by using glassy carbon and Pt working electrodes, respectively. The electrode reaction mechanisms and particle evolution principles in molten salt were discussed. Transient electrochemical techniques show that Ti₂O₃ is reduced to Ti metal by a two-step mechanism involving the exchanges of one and two electrons. Continually-varied current electrolysis was conducted using a porous Ti₂O₃ electrode against graphite and Pt anode in the molten LiCl-KCl-Li₂O electrolyte medium at 800 °C respectively to gain insight into the electro-reduction mechanism. The results showed the oxide component was electro-deoxidized effectively and Ti metal was produced as the final product in the cathode. Our work suggests that developing a low-cost inert anode material is essential for the production of titanium by electrolysis in the future.

Keywords: Titanium; Continually-varied current electrolysis; Porous electrode; Ti₂O₃

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