Electrochemical Behaviour and Electrorefining of Cobalt in NaCl-KCl-K_2TiF_6 Melt

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The electrorefining of cobalt in NaCl-KCl-K_2TiF_6 (20 wt%) melt has been investigated. It was shown that complexes of Ti(III) and Co(II) appeared in the melt due to the reaction 2Ti(IV) + Co → 2Ti(III) + Co(II) and this reaction was entirely shifted to the right hand side. On the base of linear sweep voltammetry diagnostic criteria it was found that the discharge of Co(II) to Co metal is controlled by diffusion. The limiting current density of discharge Co(II) to metal in NaCl-KCl-K_2TiF_6 (20 wt%) melt was determined by steady-state voltammetry. The electrorefining of cobalt was carried out in hermetic electrolyser under argon atmosphere. Initial cathodic current density was changed from 0.2 A cm^{-2} up to 0.7 A cm^{-2}, the electrolysis temperature varied within 973 – 1123 K. Behaviour of impurities during cobalt electrorefining was discussed. It was shown that electrorefining led to the elimination of most of the interstitial impurities (H_2, N_2, O_2, C), with the result that the remaining impurity levels below 10 ppm impart high ductility to cobalt.

Key words: Cobalt; Molten Salts; Electrochemical Studies; Electrorefining; High Ductility.