Electrochemistry of Titanium Tetrachloride in 1-Butyl-2,3-dimethyl Imidazolium Tetrafluoroborate

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The electrochemistry of titanium tetrachloride has been examined in trialkyl-substituted imidazolium tetrafluoroborate at 65 °C. Ti(IV) reduction was studied with chronopotentiometry and cyclic voltammetry in melts with different concentrations of $TiCl_4$. The diffusion coefficient of Ti(IV) ranged between $1.1 \cdot 10^{-7}$ and $7 \cdot 10^{-8}$ $cm^2\ s^{-1}$. The electroreduction of Ti(IV) was found to proceed via the sequence of one-electron steps, the relative stability of the low valence intermediates being dependent on the concentration of $TiCl_4$ in the electrolyte. The kinetics of an overlapping disproportionation reaction of Ti(II) was examined and its rate constant at low concentration (0.025 mol/l) of $TiCl_4$ was found to be $k = 2 \cdot 10^6$ $cm^3\ mol^{-1}\ s^{-1}$, Ti(0) being the final product of the stepwise reduction process at higher concentrations (0.03 – 0.14 mol/l).

Key words: Titanium; Electrochemistry; Ionic Liquids; Cyclic Voltammetry; Chronopotentiometry.