

Spectroelectrochemistry and Electrochemistry of Europium Ions in Alkali Chloride Melts

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In order to investigate the redox equilibrium of europium ions in molten NaCl-2CsCl, UV-Vis absorption spectrophotometry measurements were performed for Eu^{2+} and Eu^{3+} in molten NaCl-2CsCl at 923 K under simultaneous electrolytic control of their ratio. Molar absorptivities of EuCl_3 and EuCl_2 in NaCl-2CsCl at 923 K were determined to be $(420 \pm 21) \text{ M}^{-1} \text{ cm}^{-1}$ at 31200 cm^{-1} and $(1130 \pm 56) \text{ M}^{-1} \text{ cm}^{-1}$ at 30300 cm^{-1} , respectively. The formal redox potential of the $\text{Eu}^{2+}/\text{Eu}^{3+}$ couple in NaCl-2CsCl melt at 923 K was determined to be $(-0.941 \pm 0.004) \text{ V}$ vs. Cl_2/Cl^- by electromotive force measurements on varying concentration ratios of Eu^{2+} and Eu^{3+} , which were performed using a technique based on the combination of electrolysis and spectrophotometry. Cyclic voltammetry was also carried out in order to examine the characteristics of the voltammograms for the $\text{Eu}^{2+}/\text{Eu}^{3+}$ couple in NaCl-2CsCl melt. The formal redox potential of the $\text{Eu}^{2+}/\text{Eu}^{3+}$ couple determined by a spectroelectrochemical method agreed with that determined by cyclic voltammetry $[(-0.946 \pm 0.008) \text{ V vs. } \text{Cl}_2/\text{Cl}^-]$. The effects of temperature on the redox potential of the $\text{Eu}^{2+}/\text{Eu}^{3+}$ couple in NaCl-2CsCl, NaCl-KCl, LiCl-KCl, and CsCl melts were studied by cyclic voltammetry in the range from 923 to 1123 K.

Key words: Molten Salt; NaCl-2CsCl; Europium; Spectroelectrochemistry; Cyclic Voltammetry.