Characterization and Analysis of Chromium Coating Electrodeposited on Brass in ChCl-EG Deep Eutectic Solvent

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Black chromium coating was electrodeposited on brass substrate from choline chloride-ethylene glycol (ChCl-EG) deep eutectic solvent (DES), via potentiostatic electrodeposition method. Cyclic voltammetry method was used to study the electrochemical reduction behavior of trivalent chromium ions (Cr^{3+}) in ChCl-EG deep eutectic solvent. The composition and morphology of coating were characterized by X-ray photoelectron spectroscopy and scanning electron microscopy. The results showed that the electrochemical reduction of Cr(III) followed a two-step process, Cr(III) to Cr(II), and Cr(II) to Cr(0). Furthermore, the results indicated the existence of Cr and O elements in the coating, which was composed of chromium oxide, chromium hydroxide, and metallic chromium. Formation of the mixed phase was primarily caused by water molecules existing in the ChCl-EG deep eutectic solvent.

Keywords: Deep eutectic solvent; Chromium; Electrodeposition; Electrochemical reduction behavior; Morphology

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