Conductivity, Electrodeposition and Magnetic Property of Cobalt(II) and Dysprosium Chloride in Zinc Chloride-1-Ethyl-3-Methylimidazolium Chloride Room Temperature Molten Salt

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Electric conductivity of the molten zinc chloride-1-ethyl-3-methylimidazolium chloride phases has been measured by a computerized system using the d.c. four-probes method. The sequence of the conductivities for the different component melts is $ZnCl_2$-EMIC $>$ $ZnCl_2$-EMIC-$CoCl_2$ $>$ $ZnCl_2$-EMIC-$DyCl_3$ $>$ $ZnCl_2$-EMIC-$CoCl_2$-$DyCl_3$. The results may be explained in terms of the viscosity increase due to the complex formation.

The electrochemistry and the nucleation mechanism of cobalt(II) or/and dysprosium chloride in acidic $ZnCl_2$-EMIC melts have been investigated by cyclic voltammetry and chronoamperometry at different temperatures, respectively. The results of the SEM and VSM analyses reveal that reduction of Dy^{3+} to Dy^{2+} may have occurred, while reduction of Dy^{3+} to Dy(0) is conjectured to play no role. Moreover, the results of chronoamperometry experiments show that nucleation in the alloy electrodeposition is instantaneous, and that, as the applied deposition potential becomes more negative, the nucleation density increases, which rapidly shortens the time required for the diffusion zones to overlap.

Electrodeposition of a Dy-Co-Zn alloy on a Ni or Cu sheet from the 50-50 mol% $ZnCl_2$-EMIC melt containing 1.687 mol% $CoCl_2$ and 1.114 mol% $DyCl_3$ has been accomplished, and the morphology and the composition have been analyzed by SEM and EDS, respectively. The magnetism of the deposited layer is discussed based on the results of the VSM analysis.

Key words: Conductivity, Cyclic Voltammetry, Electrodeposition, Magnetic Property