

Electrodeposition and Corrosion Resistance of Zn-Pd Alloy from the ZnCl_2 -EMIC(1-ethyl-3-methylimidazolium chloride)- PdCl_2 Room Temperature Molten Salt

Hsin-Yi Hsu and Chao-Chen Yang

Department of General Education, The Overseas Chinese Institute of Technology,
100 Chiao-Kwang Road, Taichung 407, Taiwan, R. O. C.

Reprint requests to Prof. C.-C. Yang. E-mail: yangcc@flame.yuntech.edu.tw. Fax: 886-5-531-2056

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Electric conductivities of 50-50 mol% ZnCl_2 -EMIC and its mixtures with 0.6714 mol% PdCl_2 room-temperature molten salts (RTMS) have been measured by a computerized system based on a d.c. four-probe method. The conductivity of the former is greater than that of the latter. These conductivities are well fitted by Arrhenius equations and the activation energies are calculated to be 25.22 and 26.28 kJ/mol, respectively. Cyclic voltammetry for the ZnCl_2 -EMIC- PdCl_2 melt has been performed on Pt and Cu working electrodes. The cathodic reduction waves of Pd^{2+} and Zn^{2+} species and the oxidation waves for Zn-Pd alloys rich in Zn and Pd have been observed for the cyclic voltammograms on the Pt working electrode. The deposition potentials have been measured to be -0.7 V and -1.3 V on the Cu substrate. The morphology and composition of the electrodeposited layers obtained under different conditions have been analyzed by SEM and EDS, respectively; layers with a finer (about 300 – 500 nm), denser and higher Pd content have been obtained by pulse plating on the Cu sheet at $t_{\text{on}}/t_{\text{off}} = 3/1$ under -0.7 V at 80°C . The XRD patterns also reveal that the structure of these deposited layers can be regarded as amorphous. Tafel polarization curves of the electrodeposited layers in 3.5 wt% NaCl solution have been drawn. The results indicate that the Zn-Pd alloy deposits have much higher corrosion resistance and protection efficiency than the Zn-deposited layer; the corrosion potentials shift positively by about 700 ~ 950 mV. Furthermore, the pulse plating has a better performance than the direct current plating, and the reason is discussed.

Key words: Room Temperature Molten Salt, Cyclic Voltammetry, Electrodeposition,
Corrosion Resistance