Effect of Electrolyte Composition on Zn Electrode in Weak Acidic Aqueous Electrolyte

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The electrochemical behavior of zinc and polyaniline (PANI) obtained by the oxidative polymerization of aniline in 1.0 M aqueous HCl by $(\text{NH}_4)_2\text{S}_2\text{O}_8$ were investigated in $\text{ZnCl}_2 + \text{NH}_4\text{Cl}$ (chloride electrolyte), $(\text{NH}_4)_2\text{SO}_4 + \text{ZnSO}_4$ (sulfuric acid electrolyte), and $(\text{NH}_4)_2\text{SO}_4 + \text{ZnSO}_4 + (\text{CH}_3\text{COO})_2\text{Pb}$ (acetic acid electrolyte) with the addition of Na-citrate and Na-malonate. Compared with sulfuric acid electrolyte and acetic acid electrolyte, zinc electrode shows the minimum of charge transfer resistance (R_{ct}) and lower corrosion current densities, and polyaniline (PANI) keep high electrochemical activity in the chloride electrolyte at pH 4.0. The formation of zinc dendrite and the hydrogen evolution of the zinc electrode were suppressed in chloride electrolyte. The potentials were limited to 1.5 V for charge and to 0.7 V for discharge at 50 mA g^{-1} , obtained the initial discharge specific capacity of 109.5 mAh g^{-1} , the columbic efficiency remained at around 100% after 1000 times charge-discharge cycles.

Keywords: zinc, polyaniline, dendrites, aqueous electrolyte, rechargeable batteries

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