Electrocatalytic Activity of Ti/Al/Ti/PbO₂-WC Rod Composite Electrodes During Zinc Electrowinning

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Ti/Al/Ti/PbO₂-WC rod composite electrodes and Ti/PbO₂-WC composite electrodes were prepared by pulse current electrodeposition in a lead nitrate solution that contains WC microparticles, and the electrocatalytic activity of Ti/Al/Ti/PbO₂-WC rod composite electrodes was emphasized. The surface microstructure was characterized by scanning electron microscopy (SEM), and the electrocatalysis of the oxygen evolution behavior was investigated using anodic polarization curves and cyclic voltammetry curves in a synthetic zinc electrowinning electrolyte of 50 g·L⁻¹ Zn²⁺ and 150 g·L⁻¹ of H₂SO₄ at 40°C. The results show that applying the Ti/Al/Ti rod substrate can clearly decrease the grain size of the PbO₂ electrodes, and the surface of electrodes become more compact. Compared with the titanium substrate electrode, applying the Ti/Al/Ti rod substrate can obviously increase the exchange current density j^0 of the PbO₂-WC composite electrode during the process of oxygen evolution, reduce the apparent activation energy E_a of the oxygen evolution reaction, increase the values of electric double layer capacitance C_{dl} during the charging process, and improve the electrocatalytic stability. Employing the Ti/Al/Ti rod as the substrate of a composite electrode can effectively improve the electrode coating microstructure, increase the electrocatalytic activity of the oxygen evolution reaction in the electrolytic zinc liquid and exert positive effects on the application of the new substrate composite electrode.

Keywords: PbO₂-WC composite inert anodes, Ti/Al/Ti rod substrate, Zinc electrowinning, Electrocatalytic activity

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