

Study on Performance Enhancement of Mixed Metal Oxide Anode Coated on Titanium Substrate

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Abstract: The composite anode of mixed metal oxide (MMO) coated on titanium substrate has been widely used in the impressed current cathodic protection against corrosion, electro-chlorination of seawater for bio-fouling control and some other electrochemical industries. Stability and electrochemical activity are very important properties of MMO anode, and need to be improved for application in some harsh conditions. This paper deals with the performance enhancement of MMO anodes modified by depositing interlayer of tantalum between the active oxide coating and the titanium substrate. TaOx interlayer was prepared by thermal decomposition in inert atmosphere. The results showed that the TaOx interlayer was amorphous consisting of multivalent Ta oxides. The electrocatalytic activity for oxygen evolution reaction and the stability of the composite anodes were improved obviously with adding the TaOx interlayer of appropriate thickness, which can be attributed to the increase of electrochemically active sites and the extra protection for Ti substrate by the non-stoichiometric TaOx interlayer.

Additionally, we have developed a composite anode of Ti/Ta-Ti/IrO₂-Ta₂O₅ with a Ta-Ti alloy interlayer deposited on Ti substrate by dual glow plasma surface alloying. The investigation indicates that the electrode with Ta-Ti alloy interlayer reduces the agglomerates of precipitated IrO₂ nanoparticles and refines the grain size of IrO₂, thereby increasing the number of active sites and enhancing the electrocatalytic activity. The significant improvement in electrochemical stability is attributed to the Ta-Ti interlayer, which offers high corrosion resistance and effective protection for the titanium substrate.

Keywords: Oxide anode; Tantalum-Titanium interlayer; Thermal Decomposition; Double-glow plasma surface alloying technology