Preparation and Characterization of Ti/SnO₂-Sb Electrodes without or with a Platinum Interlayer Using the Polymeric Precursor Method and Thermal Decomposition

Leonardo Salgado¹, Carolina Blas Pozos², Teresa Zayas³, Laura Galicia¹

¹ Departamento de Química, Universidad Autónoma Metropolitana Iztapalapa, A.P. 55-534, C.P. 09340 CDMX, México

² TESOEM, División de Ingeniería Ambiental, Estado de México, C.P. 56400, México

³ Postgrado en Ciencias Ambientales y Centro de Química, Instituto de Ciencias. Benemérita Universidad Autónoma de Puebla, A.P. 1613, C.P. 72000, Puebla, México

*E-mail: lsj@xanum.uam.mx or lsalgadoj@gmail.com

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SnO₂-Sb electrodes on a Ti substrate, prepared without (Ti/SnO₂-Sb) or with a Pt interlayer (Ti/Pt/SnO₂-Sb), were prepared using the polymeric precursor method followed by thermal decomposition. The platinum film on titanium (Ti/Pt) was prepared by thermal decomposition of an alcoholic solution of Pt. Scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and elemental mapping were used to characterize the surfaces of Ti/Pt, Ti/SnO₂-Sb, and Ti/Pt/SnO₂-Sb. The electrochemical characterization of the electrodes was performed using cyclic voltammetry in a 0.5 M H₂SO₄ solution. The electroactive area of the electrodes was determined using measurements of the electrosorption hydrogen charge for Ti/Pt and the capacitance of the electric double layer for Ti/SnO₂-Sb and Ti/Pt/SnO₂-Sb. Tafel slopes for the oxygen evolution reaction (OER) were estimated from polarization curves. The SEM and EDS results obtained from the electrodes prepared with or without a platinum interlayer displayed distinct behaviors. In the absence of Pt, the SnO₂-Sb coating on titanium formed a compact layer with a good distribution of Sn, Sb, O, and a low Ti content. In the presence of the Pt coating, SnO₂-Sb was heterogeneously distributed. The heterogeneous character of the Ti/Pt/SnO₂-Sb film resulted from surface segregation during the calcination process. The voltammetric behaviors of the SnO₂-Sb electrodes prepared with or without a Pt interlayer displayed similar trends, although the presence of Pt produced a greater electroactive area and shifted the oxygen evolution potential toward less positive values; therefore, the electrocatalytic activity toward the OER was higher compared to the Ti/SnO₂-Sb electrode. The Tafel slope estimated for Ti/Pt/SnO₂-Sb is consistent with a mechanism in which OH[•] generation is the rate controlling step.

Keywords: Electrodes, Ti/Pt, Ti/SnO₂-Sb, Ti/Pt/SnO₂-Sb, Preparation, Characterization

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