Electrocatalytic Behavior of Pt/WO₃ Composite Layers Formed Potentiodynamically on Tungsten Surfaces

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The Pt/WO₃ composites, in a form of thin layer on W support, were prepared by potentiodynamic polarization of either bare or oxide covered tungsten disc in hexachloroplatinic acid solutions. Both the Pt loading and the thickness of WO₃ interlayer between Pt nanoparticles and W metal surface were varied. The chemical and electrochemical stability tests in 0.1 mol dm⁻³ HClO₄ solution were performed by cyclic voltammetry. These test revealed that the shape of cyclovoltammetric curves displayed relatively slight dependence on the number of cycles. The shape changes were attributed to a slight redistribution of WO₃ over the composite surface. Tracking for the synergistic effects in the Pt/WO₃ system, the influence of both WO₃ thickness and Pt loading on the kinetics of both hydrogen evolution/oxidation (HER/HOR) and oxygen reduction reactions (ORR) in acidic solution were investigated. The kinetics of HER was found to be a) independent on the WO₃ thickness, and b) inversely proportional to the Pt loading. For ORR we found that the onset potential, approaching thermodynamic limit of 1.23 V vs. RHE, was almost independent on oxide thickness, while the reaction kinetics was commensurable to the Pt loading.

Keywords: platinum, tungsten-oxide, hydrogen oxidation, hydrogen evolution, oxygen reduction

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