البحث الاول

Evolution of the electrocatalytic properties of Tungsten electrode towards hydrogen evolution reaction in acidic solutions

Abstract:

Hydrogen has concerned interest universally as an environmentally nontoxic and renewable fuel. Electrocatalytic hydrogen evolution reaction (HER) is one of the utmost favorable methods for hydrogen creation on a vast scale; however, the high cost of Pt based supplies, which demonstrate the highest activity for HER, forced investigators to look for cheaper electro-catalysts. Tungsten has been considered as an effective, active and low cost electrocatalyst for the hydrogen evolution reaction, mostly in alkaline media, and we have investigated here its behavior in acid electrolytes. HER has been studied utilizing linear polarization technique and electrochemical impedance spectroscopy (EIS). It happens on W at rather low overpotential (0.32 V vs. NHE at 10 mA cm2, in 0.5 M H2SO4), yet more cathodic than the widely used Pt/C catalyst, but not so far from more sophisticated systems developed recently. The effect of acid concentration on the HER rate and the electrode stability was investigated. Cathodic transfer coefficient and exchange current density were calculated for the HER from Tafel curves obtained in H2SO4 solution at concentrations ranging from 0.1 to 3.0 M. EIS experiments were performed under both open circuit and/or cathodic polarization. It was found that the hydrogen evolution rate is relatively high under low overpotential, confirming that W is a possible applicant to substitute more expensive electrocatalysts usually used for the HER under acidic conditions. The process is economic and appropriate with no need for specific treatments, as supported by additional X-ray diffraction (XRD), Atomic force microscopy (AFM) and X-ray photoelectron spectroscopy (XPS) characterization of the tungsten electrode surface.

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