Electrochemical Activity of Thin-Film Pd Catalysts Modified with Bi for Methanol and Ethanol Oxidation Reaction in Alkaline Solution

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Thin-film Pd catalysts with low metal loadings (55 and 110 $\mu\text{g cm}^{-2}$) were obtained by electrodeposition from a surfactant-free green electrolyte on glassy carbon (GC) electrode. Pd/GC catalysts were modified by addition of various amounts of Bi via irreversible adsorption. The catalysts were characterized by atomic force microscopy (AFM) and then studied in methanol oxidation reaction (MOR) and ethanol oxidation reaction (EOR) in alkaline solution. Electrochemical tests shown that the modification of the appropriate amount of Bi on Pd/GC catalyst enhance activity toward MOR and EOR up to about 2-3 times compared to unmodified catalysts. Besides surface Bi coverage (Θ_{Bi}) of 0.6 increase durability and provides more poisoning tolerant Pd/GC electrode in both studied reactions. The improvement of electrochemical performances of Bi modified Pd/GC catalysts is attributed to the third body effect and the bifunctional mechanism.

Keywords: Electrodeposition; Palladium; Bismuth adsorption; Alcohol oxidation; Atomic force microscopy.

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