

Comparative electrocatalytic oxidation of ethanol, ethylene glycol and glycerol in alkaline medium at Pd-decorated FeCo@Fe/C core-shell nanocatalysts

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Abstract

Electrocatalytic oxidation of alcohols in alkaline solutions is critical for the development of direct alkaline alcohol fuel cells (DAAFCs). This work investigated alcohol oxidation reaction (AOR) at a novel palladium-based core-shell nano catalyst (FeCo@Fe@Pd/C) obtained by the microwave-induced topdown nanostructuring and decoration (MITNAD) synthetic strategy. The electrocatalytic properties of the FeCo@Fe@Pd/C towards the oxidation of ethanol (EtOH), ethylene glycol (EG) and glycerol (Gly) were explored, and compared with those of the Pd/C alone. FeCo@Fe@Pd/C exhibited a remarkable performance in all three alcohols but its best electrocatalytic activity was found in the oxidation of EG where the electrocatalytic rate constant (K_{cat}) was about 2 times faster than seen in Gly and ≈ 4 times faster than in EtOH. The excellent performance towards EG was further corroborated by the low resistance to charge transport. Detailed comparison with literature reports shows that the FeCo@Fe@Pd/C is a potentially viable nanocatalyst for use in DAAFC.