Facile One-pot Synthesis of Carbon Supported PdCuCo Nanoalloy Catalysts for Formic Acid Electrooxidation

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PdCuCo/C nanoalloy catalysts were prepared via a facile one-pot liquid phase chemical reduction. Ethylene glycol was used as the reducing agent and reaction media, trisodium citrate as the stabilizer, and acid-pretreated Vulcan XC-72R carbon powder as the carrier material. The morphology, structure, and electrochemical performances of the as-prepared PdCuCo/C nanoalloy catalysts were characterized and analyzed. The PdCuCo alloy nanoparticles are uniformly dispersed on the carbon surface with a smaller particle size than that of Pd/C. The PdCuCo/C catalysts showed higher catalytic activity and stability for the oxidation of formic acid compared with the Pd/C catalyst prepared via the same method. The oxidation peak current density of PdCuCo/C reaches 60.0 mA cm^{-2} , which is 1.8 times that of the Pd/C. The chronoamperometry curves reveal that the current density of PdCuCo/C catalyst is 6.7 times that of the Pd/C catalyst after 3600 s. The electrochemically active surface area (ESCA) of the PdCuCo/C catalysts ($99.5 \text{ m}^2 \cdot \text{g}^{-1}$) is much higher than that of the Pd/C ($55.7 \text{ m}^2 \cdot \text{g}^{-1}$). These results indicate that the PdCuCo/C nanoalloy catalysts show great potential as anode electrocatalysts in direct formic acid fuel cells (DFAFCs).

Keywords: PdCuCo/C; Nanoalloy; Electrocatalyst; Formic acid oxidation

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