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Silica nanosphere supported palladium nanoparticles encapsulated with graphene: high-performance electrocatalysts for methanol oxidation reaction

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Abstract

A new type of silica nanosphere supported palladium nanoparticles encapsulated with graphene (denoted as Pd/SiO₂@RGO) sandwich nanostructure electrocatalyst is prepared via a two-step reduction method for the first time. The characterization of electrocatalyst morphology and composition is discussed by X-ray diffraction (XRD), transmission electron microscopy (TEM), X-ray photoelectron spectroscopy (XPS) and Raman spectroscopy. The TEM and XRD results show that palladium nanoparticles (Pd NPs) with a narrow size distribution are uniformly dispersed between silica sphere and the graphene layer. The ternary hybrid electrocatalyst exhibits high activity (1533 mA mg⁻¹_{pd}), superior operational durability and anti-poisoning ability ($I_r/I_b=3.9$) compared with other controlled Pd catalysts.

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