Pd Nanoparticles-Supported Carbon Nanotube-Encapsulated NiO/MgO Composite as an Enhanced Electrocatalyst for Ethanol Electrooxidation in Alkaline Medium

In this work, an easy method is developed to prepare well-dispersed palladium nanoparticles into the carbon nanotube (CNT) encapsulated NiO/MgO nanocomposite by the chemical reduction method. CNT encapsulated NiO/MgO nanocomposite were prepared by autogenous pressure at elevated temperature (RAPET) method. The Pd/(NiO/MgO-CNT) catalyst was characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM), higher resolution-transmission electron microscopy (HR-TEM), Raman spectroscopy and electrochemical analysis. Electrochemical measurements demonstrate the as synthesized Pd/(NiO/MgO-CNT) catalysts exhibit superior electrochemical performance compare to the commercial Pd/C catalysts. The current densities of the main anodic peak of electrooxidation of ethanol increases sharply for the Pd/(NiO/MgO-CNT) (98.20 mA/cm²), which are ~2.1 times as large as that of Pd/C (47 mA/cm²). The excellent electrochemical performance can be attributed on the one hand to the incorporation of NiO/MgO on palladium on the other hand to the porous tubular morphology of the CNT leads to high dispersion of Pd nanoparticles and also enhances the mass transport of the electrode.