

Dendrimer Mediated In Situ Preparation of Size-Controlled Platinum-Nickel Alloy Nanoparticles on Carbon Nanotubes as Electrocatalysts for Methanol Oxidation

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Abstract

Pt_xNi_y alloy nanoparticles with different compositions were prepared on Carbon Nanotube (CNT) surfaces in the presence of amine-terminated poly(amido amine) dendrimer as a scaffold. Pt_xNi_y alloys with an average diameter of 2–3 nm were uniformly deposited on dendrimer bound on CNT. The formation of the Pt_xNi_y alloys and the presence of Pt(0), Ni(0), Ni(OH)₂ and NiOOH were revealed from X-ray diffraction and X-ray photoelectron spectroscopic results. The total metal content in the Pt_xNi_y alloys increased with increasing the supplied Ni precursor, and the addition of Ni to Pt could lead the alloy formation with high thermal stability. It should be noted that the bimetallic nanoparticles with Ni up to 20 wt% showed efficient catalytic activity for methanol oxidation in proportion to Pt catalyst. This study demonstrates the promising alternative for the high demand of Pt in the cathode catalysts of direct methanol fuel cells.

Keywords: Carbon Nanotube, Dendrimer, Electrocatalyst, Methanol Oxidation, Platinum-Nickel Alloy