Au@Ag Core-shell Nanoparticles Supported on Carbon Nanotubes as Promising Catalysts for Oxygen Electoreduction

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Bimetallic nanoparticles with core-shell structure usually demonstrate enhanced catalytic performance due to the lattice strain created between the core and the shell region. The Au@Ag core-shell nanoparticles with different Au-to-Ag molar ratios were firstly fabricated by a facile method under mild conditions, and the n(Au): n(Ag) = 1: 2 sample showed the best electrocatalytic activity toward oxygen reduction reaction (ORR), a key reaction which plays an important role in fuel cells and metal-air batteries. Subsequently, the Au@Ag nanoparticles of n(Au): n(Ag) = 1: 2 were loaded on carbon nanotubes to prepare nanocomposite catalysts with different metal mass ratios of 20% Au@Ag/CNTs, 30% Au@Ag/CNTs, 40% Au@Ag/CNTs, and 50% Au@Ag/CNTs. The characteristics of the as-synthesized nanocomposites were examined by transmission electron microscopy (TEM), X-ray diffraction (XRD) and X-ray photoelectron spectroscopy (XPS) as well. The nanocomposites demonstrated effective electrocatalytic performance toward ORR. Electrochemical tests showed that the 30% Au@Ag/CNTs sample exhibited the highest activity among the series, in aspects of onset potential and kinetic current density. Furthermore, the sample of 30% Au@Ag/CNTs exhibited markedly higher long-term stability than Pt/C. The results clearly illustrate that the Au@Ag core-shell nanoparticles-based nanocomposites hold great potentials as efficient ORR catalysts for fuel cell applications.

Keywords: Au@Ag core-shell nanoparticles; Carbon nanotubes; Nanocomposite catalyst; Oxygen reduction reaction; Fuel cell

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