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Preparation of Hollow Co/Au/Pt Nanocatalysts for Methanol Oxidation

Improvement of Pt-based catalysts for direct methanol fuel cell applications based on increasing surface area and changing chemical composition of the catalysts have been studied intensively [1,2]. Moreover, there are few studies [3,4], which use hollow trimetallic Co/Au/Pt nanoparticles (Co/Au/Pt NPs) to catalyze methanol oxidation. A comparison of the catalytic performances for the methanol oxidation of monometallic Pt nanoparticles (Pt NPs) and the Co/Au/Pt NPs still has not been investigated. Thus, this work aim to investigate the catalytic activity of the Co/Au/Pt NPs supported on multi-walled carbon nanotubes (MWCNTs) for the methanol oxidation. In this study, an attention of synthesis of the Co/Au/Pt NPs and catalytic activity investigation of the synthesized Co/Au/Pt NPs supported on the MWCNTs for the methanol oxidation has been introduced and paid on. The Co/Au/Pt NPs were produced successfully via a simple successive reduction method. The transmission electron microscopy (TEM) is used to investigate structure of the Co/Au/Pt NPs and the TEM images show that the Co/Au/Pt NPs compose of hollow structure. The ultraviolet-visible spectroscopy (UV-vis) is used to investigate optical properties of the Co/Au/Pt NPs. The UV-vis results reveal that the Co/Au/Pt NPs show no absorption peak in the UV-vis region which is similar to the absorption behavior of the Pt NPs. These results can confirm deposition of Pt. The wavelength-dispersive X-ray spectroscopy (WDX) is used to investigate chemical compositions of the Co/Au/Pt NPs. The WDX data confirm the existence of Co, Au and Pt in the obtained Co/Au/Pt NPs samples. Cyclic voltammetry is used to investigate the catalytic properties of the Co/Au/Pt NPs supported on the MWCNTs for methanol oxidation. All samples of the Co/Au/Pt NPs, with different molar ratio of elemental composition, exhibit higher current density than that of the Pt NPs supported on the MWCNTs. The results show that combination of these three elements in the form of the hollow structure is promising choice for achieving good catalytic activity for the methanol oxidation.

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