Enhanced electrocatalytic performance of cobalt oxide nanocubes incorporating reduced graphene oxide as a modified platinum electrode for methanol oxidation

Abstract

Herein, we report a facile hydrothermal method for the preparation of cobalt oxide nanocubes incorporating reduced graphene oxide (rGO–Co3O4 nanocubes) for electrocatalytic oxidation of methanol. The synthesized rGO–Co3O4 nanocubes were characterized using transmission electron microscopy (TEM), field emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), and Raman techniques. The electrochemical behavior of an rGO–Co3O4 nanocube modified electrode was studied using cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) techniques. The electrocatalytic performances of rGO–Co3O4 nanocube-modified electrodes with different wt% of GO were investigated in relation to methanol oxidation in an alkaline medium. The rGO–Co3O4 nanocube modified electrode showed enhanced current density due to oxidation of methanol when compared to the bare Pt, rGO, and Co3O4 nanocube modified electrodes. The optimal GO content for an rGO–Co3O4 nanocube-modified electrode to achieve a high electrocatalytic oxidation of methanol was 2 wt%, and it showed an anodic peak current density of 362 μA cm−2.

Keyword: Anodic oxidation; Cobalt; Cyclic voltammetry; Electrocatalysis; Electrochemical impedance spectroscopy; Field emission microscopes; Graphene; Methanol; Platinum; Scanning electron microscopy; Transmission electron microscopy; X ray diffraction