One-step electrodeposition synthesis of silver-nanoparticle-decorated graphene on indium-tin-oxide for enzymeless hydrogen peroxide detection

Abstract

Silver-nanoparticles-decorated reduced graphene oxide (rGO) was electrodeposited on indium tin oxide (ITO) by a cyclic voltammetry method. The results of X-ray diffraction, Fourier-transform infrared transmission spectroscopy and Raman spectroscopy confirmed the simultaneous formation of cubic phase silver nanoparticles and reduction of GO through the electrodeposition process. Field emission scanning electron microscope images showed a uniform distribution of nanometer-sized silver nanoparticles with a narrow size distribution on the RGO sheets, which could only be achieved using silver ammonia complex instead of silver nitrate as precursor. The composite deposited on ITO exhibited notable electrocatalytic activity for the reduction of H2O2, leading to an enzymeless electrochemical sensor with a fast amperometric response time less than 2 s. The corresponding calibration curve of the current response showed a linear detection range of 0.1–100 mM (R2 = 0.9992) while the limit of detection was estimated to be 5 μM.

Keyword: Electrocatalytic activity; Electrodeposition process; Field emission scanning electron microscopes; Fourier transform infra reds; Hydrogen peroxide detections; Narrow size distributions; One-step electrodepositions; Reduced graphene oxides (RGO).