Nanocomposites of sulphur-nitrogen co-doped graphene oxide nanosheets and cobalt mono carboxyphenoxy phthalocyanines for facile electrocatalysis

Abstract

Nanocomposites consisting of cobalt mono carboxyphenoxy phthalocyanine (CoMCPhPc) either covalently linked to graphene oxide nanosheets (GONS), sulphur doped graphene oxide nanosheets (SDGONS), nitrogen doped graphene oxide nanosheets (NDGONS) or sulphur/nitrogen co-doped graphene oxide nanosheets (SNDGONS) or sequentially added were used to modify glassy carbon electrode. The modified electrodes were characterised using several techniques: voltammetry, X-ray photon spectroscopy and scanning electron spectroscopy before testing their activity on the detection of hydrogen peroxide at pH 7. The presence of SNDGONS had a significant improvement on the currents as compared to CoMCPhPc modification alone in both sequentially added or covalently linked to MPcs. CoMCPhPc-SNDGONS(seq)-GCE and CoMCPhPc-SDGONS(linked)-GCE resulted in impressive limits of detection and catalytic rate constant values of 1.58 nM and 5.44 nM, 3.07 × 105 M− 1 s− 1 and 3.01 × 103 M− 1 s− 1 respectively. Gibbs energy value was determined to be − 21.22 kJ mol− 1 for CoMCPhPc-SNDGONS(linked)-GCE indicative of a facile spontaneous electroreduction reaction on the surface of this electrode.