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Electrokinetic and Impedimetric Dynamics of FeCo-Nanoparticles on Glassy Carbon Electrode

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Abstract

The electrochemical dynamics of a film of FeCo nanoparticles were studied on a glassy carbon electrode (GCE). The film was found to be electroactive in 1 M $LiClO_4$ containing 1:1 v/v ethylene carbonate – dimethyl carbonate electrolyte system. Cyclic voltammetric experiments revealed a diffusion-controlled electron transfer process on the GCE/FeCo electrode surface. Further interrogation on the electrochemical properties of the FeCo nanoelectrode in an oxygen saturated 1 M $LiClO_4$ containing 1:1 v/v ethylene-carbonate-dimethyl carbonate revealed that the nanoelectrode showed good response towards the electro-catalytic reduction of molecular oxygen with a Tafel slope of about 120 mV which is close to the theoretical 118 mV for a single electron transfer process in the rate limiting step; and a transfer coefficient (α) of 0.49. The heterogeneous rate constant of electron transfer (k_{et}), exchange current density (i_o) and time constant (τ) were calculated from data obtained from electrochemical impedance spectroscopy and found to have values of 2.3 x 10^{-5} cm s^{-1}, 1.6 x 10^{-4} A cm^{-2} and 2.4 x 10^{-4} s rad^{-1}, respectively.