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## The study of electrophoretic deposition kinetics of graphene oxide using quartz crystal microbalance

N.A.A.B. Nissanka, S.K.N.D. Jayawardana and D.R. Jayasundara\*

*Department of Physics, University of Colombo, Colombo 03, Sri Lanka*

Electrophoretic deposition (EPD) is a simple and cost effective processing method to fabricate uniform coatings through precise control of EPD parameters. Recently, Graphene Oxide (GO) has been fabricated on various conductive substrates by EPD method. These GO films with enhanced properties are used in a wide range of applications including electrochemical sensors, biosensors and energy related materials. For these applications, it is required to have control over the film coverage. Therefore, a deeper understanding of the experimental factors that control the EPD process of GO is beneficial to fabricate coatings with enhanced properties. In this study, the early stages of deposition kinetics of GO under different EPD parameters were measured quantitatively using nanogravimetric technique. Quartz crystal microbalance (QCM) is an *in situ* real-time nanogravimetric technique used to measure adsorption and desorption mass with nano gram resolution. The kinetic measurements of GO deposition were carried out by measuring the mass deposited on a gold quartz crystal microbalance sensor for a range of deposition time (10 s to 300 s) and EPD voltage (5 V to 15 V). The QCM data shows a linear relationship for the deposited mass at the initial stage of deposition and at lower voltages (<13 V). However, at higher EPD voltage (>13 V), the growth of GO film is limited due to the passivation of the electrode. Furthermore, the data also indicates an increase in the statistical error for mass deposited over a longer period (>200 s) and higher voltages (>13 V). During EPD, the charged GO particles are deposited depending on their attractive forces towards the active electrode and repulsive forces among them. At the initial stage of deposition and at lower voltages, GO particles are deposited having much space between them to form homogeneous films. Conversely, at high voltage and high deposition time, non-uniform unstable films are formed. Thus, these findings will contribute to the existing yet limited pool of knowledge on the preparation of well controlled EPD GO films for a range of applications.

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**E-mail:** dilushanj@phys.cmb.ac.lk