# Electrochemical study of graphene oxide films supported on glassy carbon electrode

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In recent times, Graphene Oxide (GO) based materials have attracted considerable attention in the development of electrodes for a wide range of electrochemical applications. However, insulating nature of GO has limited the use of this material 'as it is' for above mentioned applications. Further, the randomness of oxygen functionalities and their inhomogeneous spatial distribution have a significant impact on the electronic properties of GO. Thus, the investigation of electrochemistry behind this intriguing material is required to realize its application potential. In this study, thin films of GO which were synthesized under different oxidation conditions using Improved Hummers method were casted on glassy carbon (GC) disk electrodes via drop casting. These GO coated electrodes were then electrochemically characterized in the presence of two redox probes potassium ferricyanide and ruthenium(Ⅲ) hexammine chloride using cyclic voltammetry (CV) to study the effect of oxygen functionalities on electron transfer properties of GOs. The CV results of these GO electrodes for potassium ferricyanide at different scan rates indicate that the electron transfer process is reversible. Further the electrochemically active surface area of GO electrodes measured was much less compared to that of bare GC. This indicates that insulating area of the GO electrodes is higher than the electrochemically active surface area owing to the surface bound oxygen functionalities of GO. Thus, these GO electrodes shows high resistance to electron transfer compared to the bare GC electrode. However, same GO electrodes in ruthenium(Ⅲ) hexammine chloride showed distinct electrochemical response characteristics to electrocatalytic process due to the presence of oxygen functionalities. In this case, electron transfer process is followed by a catalytic chemical process where electrogenerated reduced ruthenium(Ⅲ) hexammine chemically react with oxygen functionalities of GO and regenerates the starting material ruthenium(Ⅲ) hexammine. Further, significant variation can be observed in the rate constants of the chemical reaction for these GO electrodes. Therefore, these GOs can be used as electrode materials for electrochemical applications where oxygenated electrocatalytic reactions are employed.

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