Graphene-Modified Glassy Carbon Electrodes: Correlations between Electrochemical Performance, Film Morphology and Composition

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Graphene and its derivatives are generally portrayed as electron transfer enhancers that effectively boost the electrochemical response of classic electrodes for applications in renewable energy, electronics, or analysis (amongst others). However, a number of fundamental studies have challenged this view. In certain reports, not only could no beneficial effect be demonstrated, but the opposite was concluded. If we want to advance towards a more rational design of high-performance electrode devices, these discrepancies need to be cleared and the fundamental aspects of electron transfer reactions through graphene-electrodes further understood. The present study contributes to this cause by exploring the relationships between the structure and morphological appearance of graphene films and their electrochemical performance in fundamental proof-of-concept experiments. The results unveil that important differences in the structure and morphology of the films (which are tightly related to the composition and load of graphene materials) govern the electrochemical response of the modified electrodes. Thereby, a possible explanation for the apparently contradictory conclusions reported in the literature is provided.

Keywords: electrode modification, thin films and coatings, electron transfer studies, graphene oxide, reduced graphene oxide

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