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Self-assembled reduced graphene oxide nanoflakes assisted by post-sonication boosted electrical performance in gold interdigitated microelectrodes

Abstract

Reduced graphene oxide (rGO) is widely utilised to develop various types of biosensors; however, producing self-assembled rGO nanoflake networks through single-droplet drop-casting remains inconsistent. In the present work, we systematically used three different methods to prepare rGO suspensions in order to produce large scale self-assembled rGO nanoflake networks through single-droplet drop-casting. The rGO suspensions were prepared using only deionised water with no added any chemicals/organic solvents, which we considered to be a low-cost method. Subsequently, the most effective preparation method was used to deposit rGO nanoflakes onto commercial gold interdigitated microelectrodes (Au-IDE) to examine their electrical performance. Assessment of the yields, developed methods, surface morphologies, spectroscopy and structural analyses of the as-prepared rGO nanoflakes were conducted. The results revealed that method-3 (involving sonication, centrifugation and post-sonication) produced large self-assembled rGO nanoflake networks with strong adhesion to glass substrates. Furthermore, the as-prepared rGO/Au-IDE modified sensors showed excellent electron mobility where the electrical conductivity was enhanced approximately ~ 1000 fold compared to the bare devices. The present work provided new insights for depositing large self-assembled interconnected rGO nanoflake networks through single-droplet drop-casting which will be beneficial for biosensor development and other downstream applications.

Keybord

Drop-casting; Impedance; Interdigitated electrodes; Post-sonication; rGO nanoflakes