

Synthesis of N and B co-doped Graphene and Application for Replacing the Natural Peroxidase in Sensitive and Selective Bioassays

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A new carbon-based peroxidase mimic, N and B co-doped reduced graphene oxide (NB-rGO) was synthesized. NB-rGO show unprecedentedly high peroxidase-like activity without oxidase-like activity, and that has up to 1000 times higher catalytic efficiency than does undoped rGO. To understand the high catalytic activity of NB-rGO, density functional theory (DFT) was calculated about the Gibbs free energy change during the peroxide-decomposition reaction. Acetylcholine and C-reactive protein are successfully quantified with high sensitivity and selectivity, which were comparable to or better than those obtained using natural peroxidase. Furthermore, NB-rGO which doesn't have oxidase-like activity is proved to have higher sensitivity toward acetylcholine than Pt nanoparticles having oxidase-like activity. This work will facilitate studies on development, theoretical analysis for rational design, and bioassay applications of enzyme mimics based on nanomaterials.