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Prussian Blue Functionalized Graphene Composites for Electrochemical Sensing and Energy Applications

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Abstract: Graphene based nanomaterials have been a hot topic since 2004. These materials have shown some notable advantages, including large surface areas, high flexibility and reasonably good conductivity and mechanical strength, suitable for a wide range of electrochemical applications from sensors to energy technologies. In this presentation, we have explored the combination of redox active *Prussian Blue* (PB) nanostructures (e.g., core-shell Gold@*Prussian Blue* (Au@PB) nanoparticles (NPs) and interlocked PB nanocubes) with chemically exfoliated graphene to prepare multifunctional composites as electrochemical catalysts and supercapacitor electrode materials. Those nanocomposites were systematically characterized by AFM, SEM, TEM and XPS. The results confirmed all PB nanostructures were well combined with graphene nanosheets. Furthermore, PB nanostructure functionalized graphene materials were fabricated into disposable paper sensors and supercapacitor electrodes. For example, Au@PBNPs hybrid graphene oxide suspension was filtered via layer-by-layer into functional GO paper, which was further converted into electrically conductive reduced GO (RGO)/Au@PB paper via hydrazine vapour reduction. The whole procedure is outlined schematically in Fig. 1. Resulting sandwich functionalized graphene papers have sufficient conductivity and flexibility, and robust mechanical strength, which can be cut into free-standing electrodes. Such electrodes with the advantages of low cost and scalable production capacity, for example used as non-enzymatic electrochemical sensors, are of particular interest in the areas of flexible, disposable, simple and low-cost sensors.

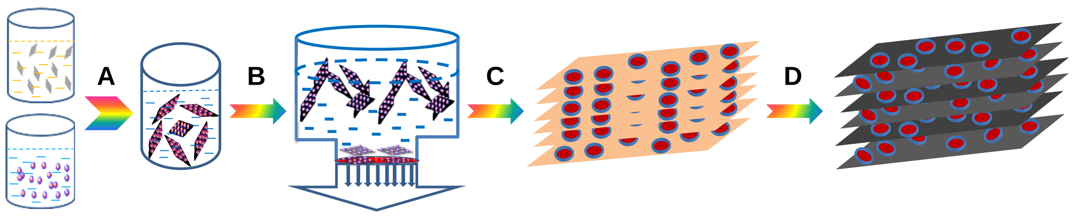

Figure 1. Schematic representation of the experimental procedure for preparation of RGO papers sandwich-like functionalized with Au@PB NPs. The four steps are: the two components are mixed (A), transferred to a vacuum filter (B), vacuum filtration to form GO paper (C) and hydrothermal vapor reduction of GO paper to RGO paper (D).

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