



## Electroactive Functionalization of Graphene as Nanohybrid Materials for Redox Sensing and Energy Storage

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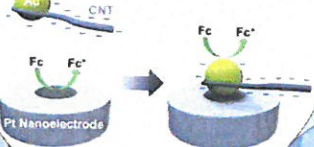
# Electrochemistry at the nanoscale from basic aspect to applications

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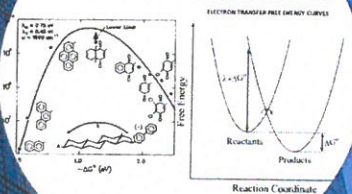
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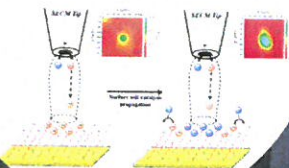
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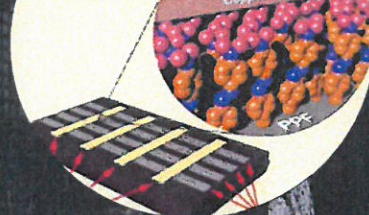
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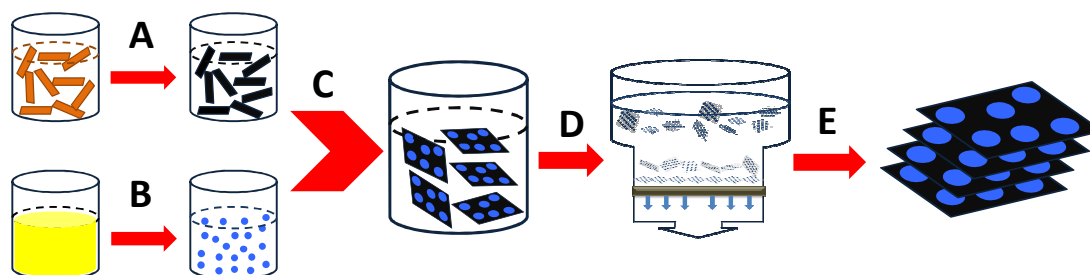
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## Electroactive Functionalization of Graphene as Nanohybrid Materials for Redox Sensing and Energy Storage

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As an atomic-scale-thick two-dimensional material, graphene has emerged as one of the most miracle materials and has generated intensive interest in physics, chemistry and even biology in the last decade.<sup>(1,2)</sup> Nanoscale engineering and functionalization of graphene is a crucial step for many applications ranging from catalysis, electronic devices, sensors to advanced energy conversion and storage.<sup>(3)</sup> In this talk, we *first* present a general theme for functionalization of graphene nanosheets, followed by showing our recent studies on electroactive functionalization of chemically exfoliated graphene materials and their potential applications in sensors, redox-based memory storage and supercapacitors. Our systems studied cover redox-active nanoparticles, electroactive supramolecular ensembles and redox enzymes which are integrated with graphene nanosheets and further transformed into thin films or graphene papers.<sup>(4-7)</sup> Figure 1 shows an example for preparation of *Prussian blue* nanoparticles (PBNPs) doped graphene oxide (GO) and reduced GO (RGO) papers.



**Figure 1. Schematic illustration of preparation of *electroactive, flexible and free-standing graphene papers*.** A) Wet-chemical conversion of GO to RGO via hydrazine reduction, B) synthesis of PBNPs starting from the mixture of FeCl<sub>3</sub> and K<sub>4</sub>Fe(CN)<sub>6</sub>, C) preparation of PBNPs-RGO hybrid nanosheets, and D) and E) processes of preparing PBNPs-RGO hybrid paper including filtration, drying and annealing.<sup>(4)</sup> Not drawn to scale.

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