Graphene Paper Doped with Chemically Compatible Prussian Blue Nanoparticles as Nanohybrid Electrocatalyst

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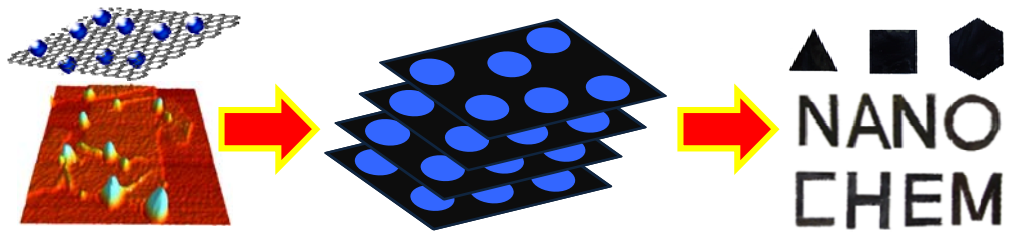
Abstract

Along with reduced graphene oxide (RGO), water soluble Prussian blue nanoparticles (PBNPs, around 6 nm) are synthesized and broadly characterized. These two types of highly stable, low-cost and chemically compatible nanomaterials are exploited as building ingredients to prepare electrically enhanced and functionally endorsed nanohybrid electrocatalysts, which are further transformed into free-standing graphene papers. PBNPs doped graphene papers show highly efficient electrocatalysis towards reduction of hydrogen peroxide and can be used alone as flexible chemical sensors for potential applications in detection of hydrogen peroxide or/and other organic peroxides. The as-prepared PBNPs–RGO papers are further capable of biocompatible accommodation of enzymes for development of freestanding enzyme based biosensors. In this regard, glucose oxidase is used as an example for electrocatalytic oxidation and detection of glucose. The present work demonstrates a facile and highly reproducible way to construct free-standing and flexible graphene paper doped with electroactive catalyst. Thanks to high stability, low-cost and efficient electrocatalytic characteristics, this kind of nanohybrid material has potential to be produced on a large scale, and offers a broad range of possible applications, particularly in the fabrication of flexible sensing devices and as a platform for electrocatalytic energy conversion.

References

[1] Nan Zhu, Shuang Han, Shiyu Gan, Jens Ulstrup, and Qijin Chi, *Advanced Functional Materials*, **23** (2013) pp. 5279-5306.
[2] Rodney S. Ruoff, *Nature*, **448** (2007), pp. 457-460.

Figures



Schematic Diagram of Graphene Paper Doped with Chemically Compatible Prussian Blue Nanoparticles as Nanohybrid Electrocatalyst