Microwave-assisted Metal Nanoparticle-embedded Porous Graphene

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Abstract

Porous graphene has extensive potential applications in variety of fields such as hydrogen storage, CO oxidation, gas separation, supercapacitors, fuel cells, nanoelectronics, oil adsorption, and so on. However, the generation of some carbon atoms vacancies for precise small holes have been not extensively studied to prevent the agglomerates of graphene sheets and to obtain porous graphene with high surface area. Recently, many research efforts have been presented to develop physical and chemical synthetic approaches for porous graphene. But physical method has very high cost of manufacture and chemical method consumes so many hours for porous graphene.

Herein, we propose a porous graphene contained holes with atomic scale precision by embedding metal nano-particles through microwave irradiation. This proposed synthetic method is appropriate for fast and convenient production of three dimensional nanostructures, which have nanoholes on the graphene surface in consequence of microwave irradiation. The metal nanoparticles are dispersed quickly on the graphene surface and generated uniform nanoholes on the graphene nanosheets. The morphological and structural characterization of the porous graphene were examined by scanning electron microscopy (SEM), transmission scanning electron microscopy (TEM) and RAMAN spectroscopy, respectively. The metal nanoparticle-embedded porous graphene exhibits a microporous volume of 2.586cm^3g^{-1} with an average pore radius of 0.75 nm. HR-TEM analysis was carried out to further characterize the microstructures. By investigating the RAMAN spectra, we can understand the structural changes of graphene. The results of this work demonstrate a possibility to produce a new class of porous graphene. Furthermore, the newly acquired knowledge for the diffusion into graphene can provide useful guidance for the development of the growth of nanostructure.

References

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Figures

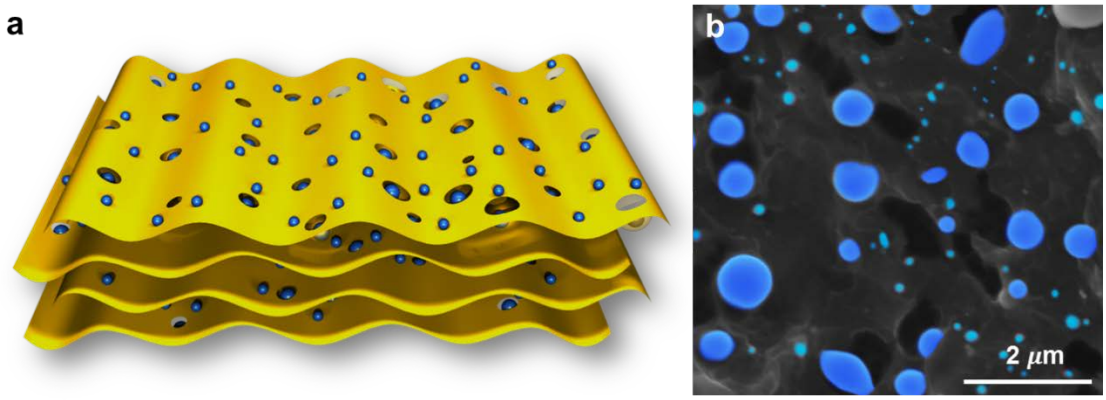

Figure 1: Microwave-assisted Metal Nanoparticle-embedded Porous Graphene. (a) Schematic illustration of Porous Graphene. (**b**) SEM image of Perforated Graphene Structures.