Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Controllable Synthesis of Porous Fe_3O_4@ZnO Spheres Decorated Graphene for Extraordinary Electromagnetic Wave Absorption

Danping Sun, Quan Zou, Yanping Wang, Yujiao Wang, Wei Jiang and Fengsheng Li*

National Special Superfine Powder Engineering Research Center, Nanjing University of Science and Technology, Nanjing 210094, China

E-mail: weij_nust2013@yahoo.com (W. Jiang); sharly.sun2013@yahoo.com (D. P. Sun).

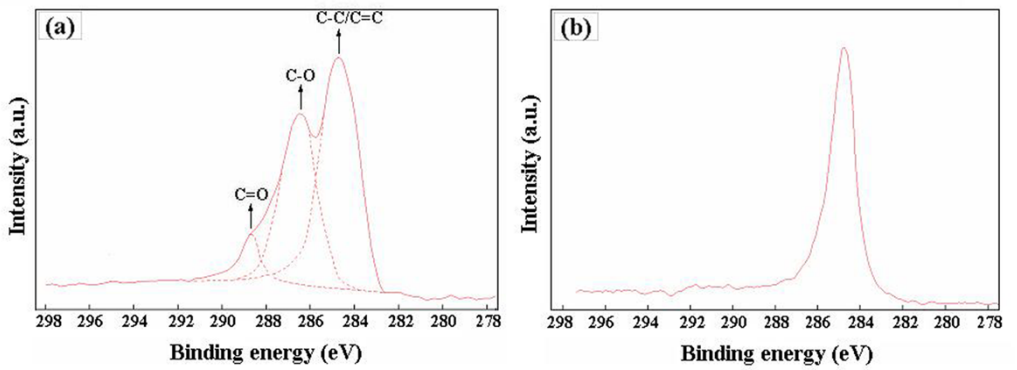

Fig. S1. The C_{1s} XPS spectra of GO and GN.

In our study, the modified GN was prepared by the exfoliation and further reduction of the homogenous GO dispersion with the presence of SDBS. It is well known that the basal sheet of GO is decorated mostly with epoxide and hydroxyl groups, in addition to carbonyl and carboxyl groups, which are located at the edges. It is fundamental to remove the oxygen functional groups and the process is called deoxygenation. In this work, we chose hydrazine as reducing agent, and the surfactant (SDBS) was added to prevent the agglomeration of the reduced platelets during reduction. The reduction process could be proved by XPS spectra which is shown in Fig. S1. The C_{1s} XPS spectrum of GO shows three different peaks centered at 284.6, 286.5 and 288.4 eV, corresponding to C=C/C-C in aromatic rings, C-O (epoxy and alkoxy), C=O groups, respectively. However, for GN, peaks at 286.5 and 288.4 eV get almost disappeared, leaving only a sharp peak of C=C/C-C, which confirms considerable degree of reduction.

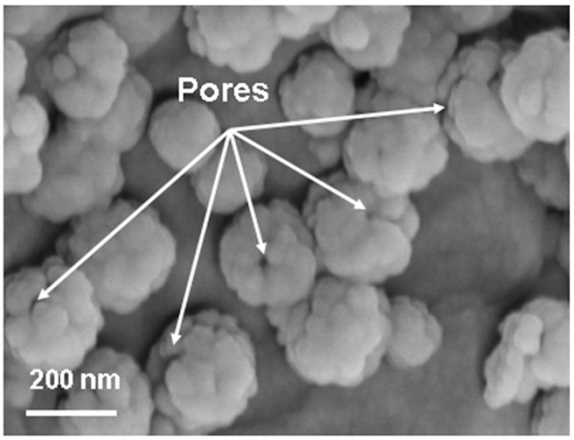

Fig. S2. FE-SEM image of the *p* Fe_3O_4 nanoparticles.

The porous Fe_3O_4 (*p* Fe_3O_4) nanoparticles were fabricated by a modified hydrothermal synthesis using complex polylol. The nanoparticles are uniform spherical, with a mean diameter of 200 nm approximately. Each particle possesses a rough surface as a result of aggregations of several irregular shaped nanocrystals, with wrinkles and pores formed together. The FE-SEM investigation confirms again the porous structure and the aggregation process of the *p* Fe_3O_4 nanoparticles, which are in accordance with the TEM results.

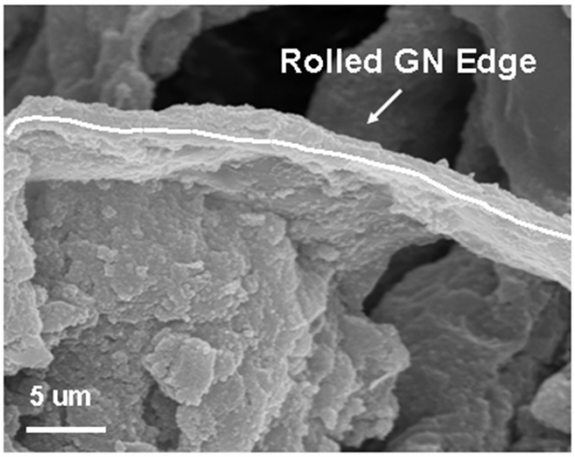

Fig. S3. FE-SEM image of the GN- *p* Fe_3O_4@ZnO composites.

The *p* Fe_3O_4@ZnO spheres decorated GN composites (GN- *p* Fe_3O_4@ZnO) were characterized by TEM. The typical TEM image reveals that *p* Fe_3O_4@ZnO spheres are uniformly coated on both sides of GN sheets like a sandwich without significant vacancy or apparent aggregation. In some cases, the thin and large two-dimension GN sheet would rolled up thus the rolled GN edge was observed, implying the GN sheet is still flexible even after the coating.

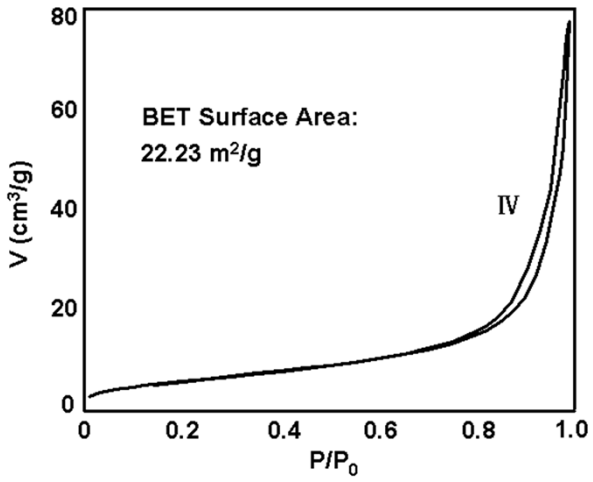

Fig. S4. N_2 adsorption-desorption isotherm curve of the *p* Fe_3O_4 nanoparticles.

The nitrogen (N_2) adsorption-desorption isotherm curve of the *p* Fe_3O_4 nanoparticles can be identified as type IV, which is characteristic of mesopores. The BET surface area of the sample was calculated to be 22.23 m^2 g^{-1}, which is much higher than the value (2.89 m^2 g^{-1}) of dense spheres with the similar diameter. All data strongly support the existence of porous structure of the spheres.