Supporting Information

Distinctly Enhanced Permeability and Excellent Microwave Absorption of Expanded Graphite/Fe₃O₄ Nanoring Composites

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Experimental Section

Preparation of EG/Fe₃O₄ nanoparticle (NP) composites: The as-obtained expanded graphite (0.5 g, expanded in a muffle furnace at 700 °C for 30 s) and PVP (2 g, Mw=40000) were added into water (150 mL), then the mixture was vigorously stirred at room temperature for 12 h. The surface-modified expanded graphite was collected by suction filtration and washed with water several times. Then, surface modified expanded graphite was added into the mixture of FeSO₄·7H₂O (0.278 g), Fe(NO₃)₃·9H₂O (0.404 g) and H₂O (150 mL) in a beaker at room temperature. After being stirred for 20 min and heated at 70 °C with dropwise added NaOH liqor (7.5 mL, 4 M) for 10 min in a water bath. The composites was collected by filtration and washed with water several times, and finally dried in a vacuum oven at 60 °C for 5 h. In order to get Fe₃O₄ NPs, the composites were sintered at 400 °C for 2 h under N₂.

Property measurement

The magnetic properties for the samples in a powder form were carried out using a Model 7404 vibrating sample magnetometer (VSM, LakeShore, USA).

The dc electrical conductivity measurements were made by the standard four-point contact method on pressed rectangular of the CNTs/CIPs composites prepared at room temperature in order to eliminate contact-resistance effects.



Fig. S1 SEM images of EG/Fe_3O_4 NR composites.



Fig. S2 SEM images of EG/Fe₃O₄ nanoparticle (NPs).



Fig. S3 Frequency dependence of electromagnetic parameters for Fe₃O₄ NR/CNT composites with various 20 % mass fractions. (a) The real (ε') and (b) imaginary (ε'') parts of the relative complex permittivity; (c) the real (μ') and (d) imaginary (μ'') parts of the relative complex permeability.



Fig. S4 Frequency dependence of Cole-Cole semicircles (ε' versus ε'') of EG with various mass fractions.



Fig. S5 Magnetic hysteresis loops of (a) EG, (b) Fe₃O₄ NRs, and (c) EG/Fe₃O₄ NR composites.