

Electronic Supplementary Information (ESI) for

Ferromagnetic hematite@graphene nanocomposites for removal of rhodamine B dye molecules from water

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Experimental Section

Synthesis of graphene oxide (GO): GO was synthesized using a modified Hummer's method.^{S1} In a typical case, 0.5 g NaNO₃ was dissolved in 23 ml of concentrated H₂SO₄, then 1 g graphite powder was added into above mixture with stirring for 10 min and cooling in an ice bath condition. The mixture was continuously stirred while 3 g KMnO₄ was added slowly for 10 min, then the above mixture was still stirring for 2 h at room temperature after removing it out of the ice bath, followed by adding 46 ml deionized water while stirring without intermitting, and the temperature will rise up to 98 °C and keeping stirring in hot water bath for 15 min. Then the mixture was got rid of the hot-water bath, and 140 ml deionized water was added with stirring for 10 min and then 10 ml 30% H₂O₂ were added in sequence. The oxidized material was then washed with 1:10 (v:v) HCl solution 440 ml and deionized water one time to remove metal ions, followed by filtration. The collected product was dried in a vacuum drying oven at 50 °C for 6 h. The GO was obtained thereafter.

Synthesis of α -Fe₂O₃-Polyvinylpyrrolidone (PVP) modified Graphene oxide (GO) nanocomposite: 25 mg GO was added into 25 ml deionized water, followed by ultrasonic treatment for 2h. 169 mg FeCl₃·6H₂O (0.625 mmol) was dissolved in 15 ml deionized water, followed by adding 112.5 mg urea (AR, 99%, Beijing Modern Orient fine chemistry reagent Ltd.) and 62.5 mg polyvinylpyrrolidone (PVP) (Mw =40000, Beijing Kebio Biotechnology Co., Ltd.) with stirring and then the solution was added dropwise into GO dispersed system with stirring for 4 h, followed by transferring to and sealing in a Teflon-lined autoclave, heated to 180 °C, and maintained at this temperature for 24 h. After the autoclave was cooled down to room temperature naturally, the products were collected by washing with deionized water, followed by drying at 80 °C for 4h. We can obtain black power.

Synthesis of α -Fe₂O₃@Polyvinylpyrrolidone (PVP)@reduced Graphene Oxide (rGO) (termed as HPG):The as-obtained black power was ground and redispersed in deionized water (40 ml), 1 ml hydrazine hydrate (NH₂-NH₂·H₂O, AR, 80%, Beijing Chemical Works) was added into the above mixture, followed by transferring to and sealing in a Teflon-lined autoclave, heated to 140 °C, and maintained at this temperature for 12 h. After the autoclave was cooled down to room

temperature naturally, the products were collected by washing with deionized water, and then drying at 80°C for 2h. The black power was α -Fe₂O₃@PVP@rGO (termed as HPG).

Characterization: The morphology was studied by Transmission electron microscopy (TEM) was carried out on a Hitachi H-7650B instrument, operating at 120 kV. The phase structure was studied by X-ray diffractometer (Druker D8 Advance) with Cu K α radiation ($\lambda = 154056 \text{ \AA}$, operating at 40 kV \times 40 mA). Raman spectra (Renishaw, RM 1000) were measured with excitation from the 514 nm line of an Ar ion laser with a power of about 5 mW. Fourier transform infrared (FT-IR) spectra were obtained on a Nicolet 560 FT-IR spectrophotometer. X-ray photoelectron spectra (XPS) were recorded on a PHI quantera SXM with an Al K $\alpha = 280.00 \text{ eV}$ excitation source, where the binding energies were calibrated by referencing the C1s peak to reduce the sample charge effect. Magnetic properties of the sample were studied by using a Physical Property Measurement System (PPMS-9T) with temperature capabilities of 10-300 K and magnetic field up to 500 Oe for measuring the magnetization.

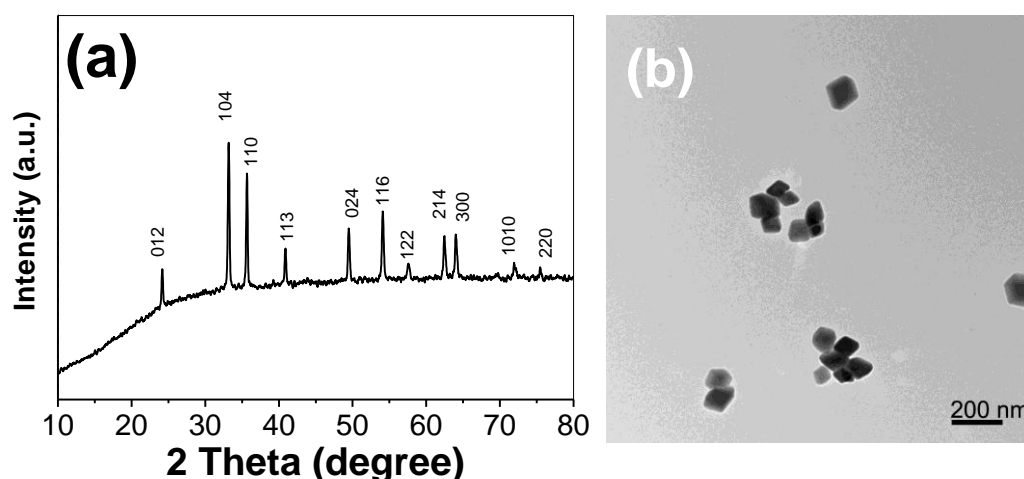


Figure S1. (a) XRD pattern, and (b) TEM image of pure α -Fe₂O₃ nanocubes.

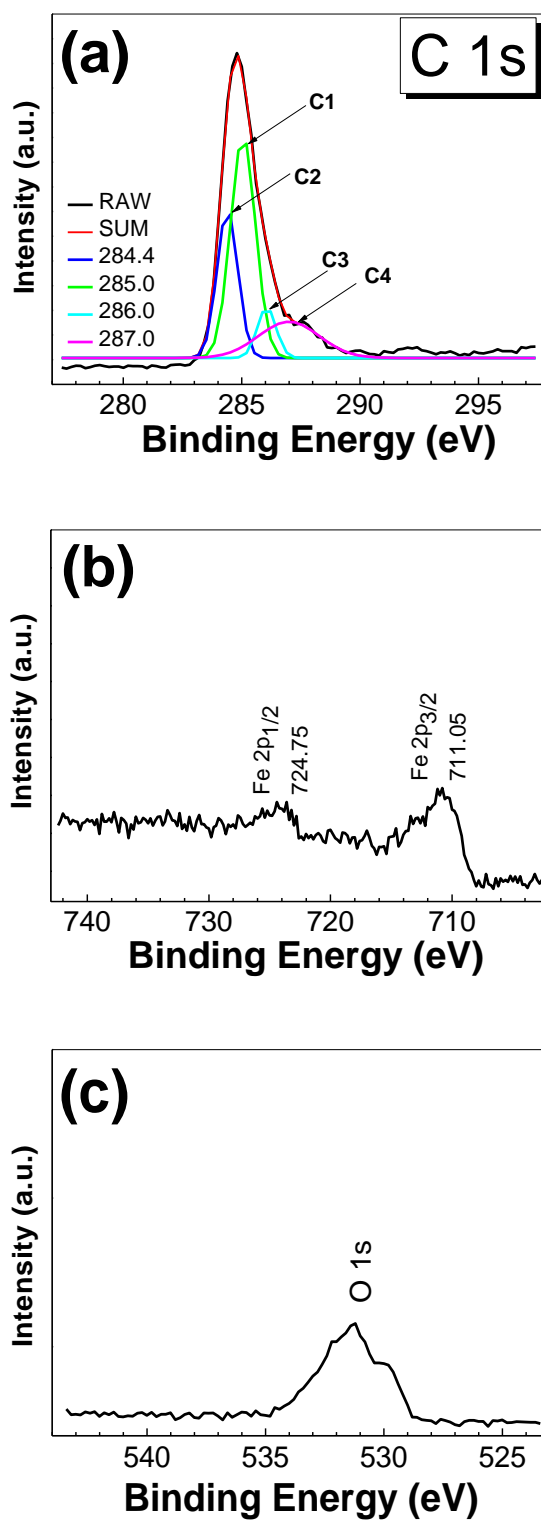


Figure S2. XPS spectra of (a) C1s, (b) Fe 2p, (c) O1s.

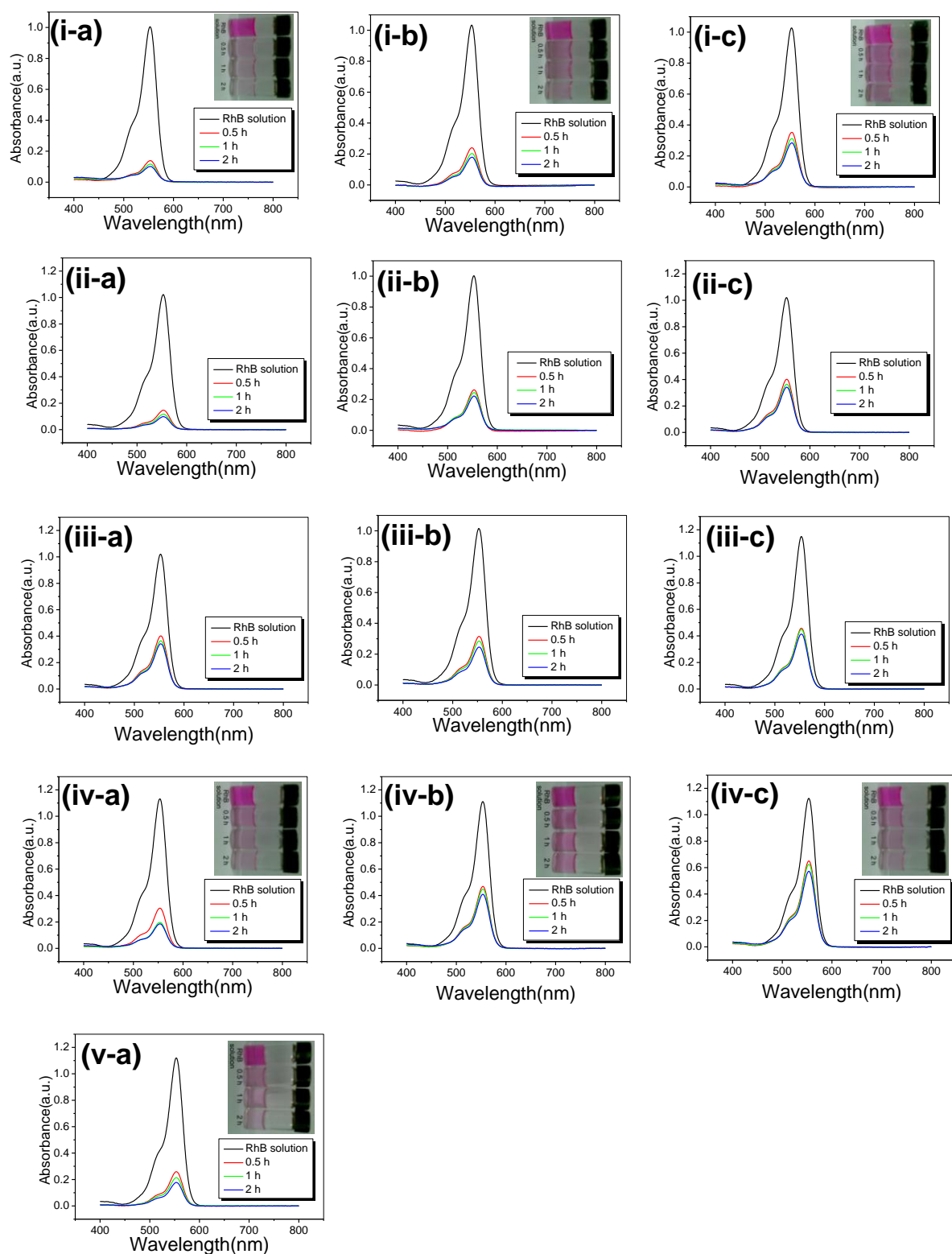


Figure S3. UV-vis absorption spectra of HPG in RhB solution in various cycles: (i) 1st cycle, (ii) 2nd cycle, (iii) 3rd cycle, (iv) 4th cycle, and (v) 5th cycle, respectively. Insets are corresponding photos.

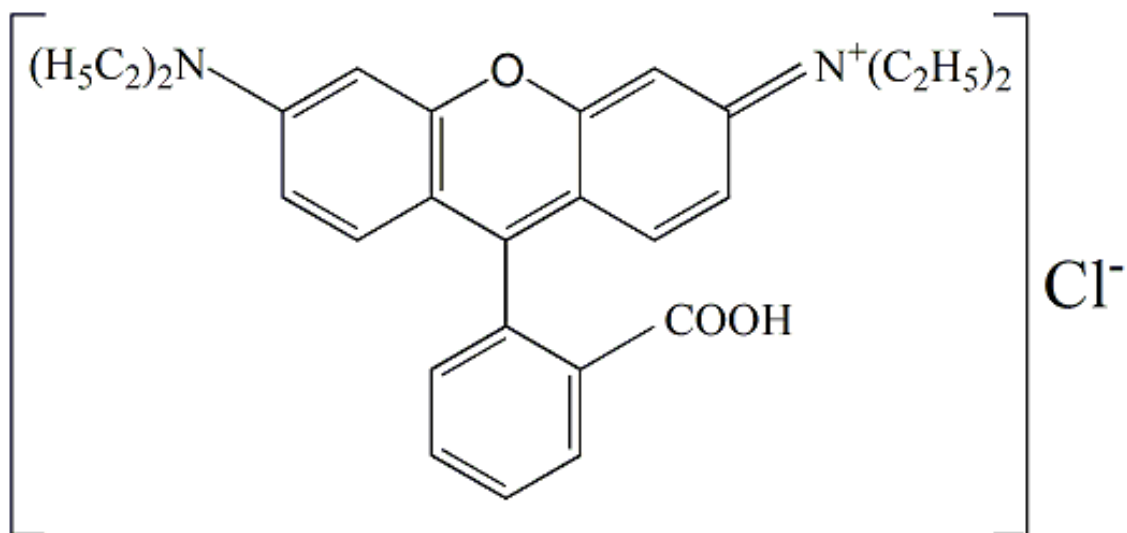


Figure S4. The molecule structure of RhB.

Reference

S1 B. Li, H. Cao, J. Shao, G. Li, M. Qu, G. Yin, *Inorg. Chem.*, 2011, **50**, 1628.