

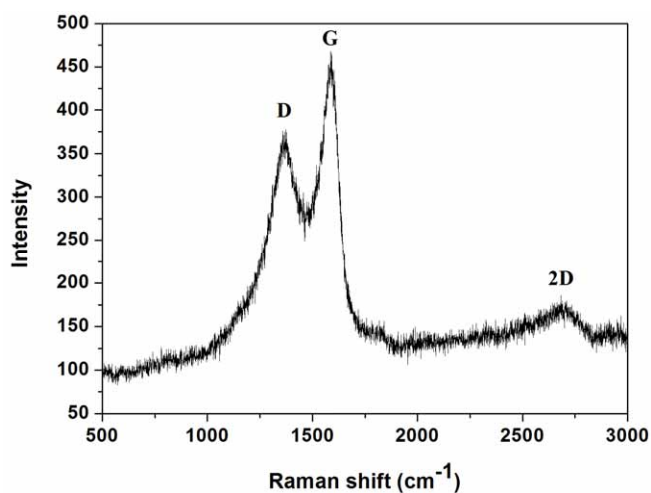
Electronic Supplementary Information

Nanosized N-doped graphene oxide with visible fluorescence in water for metal ions sensing

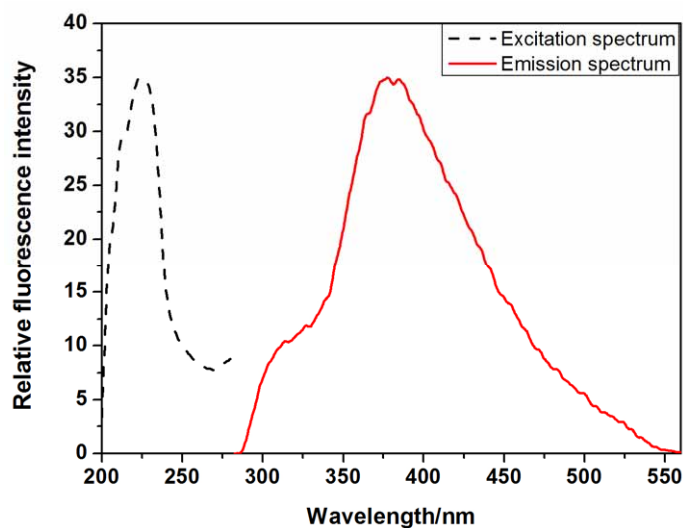
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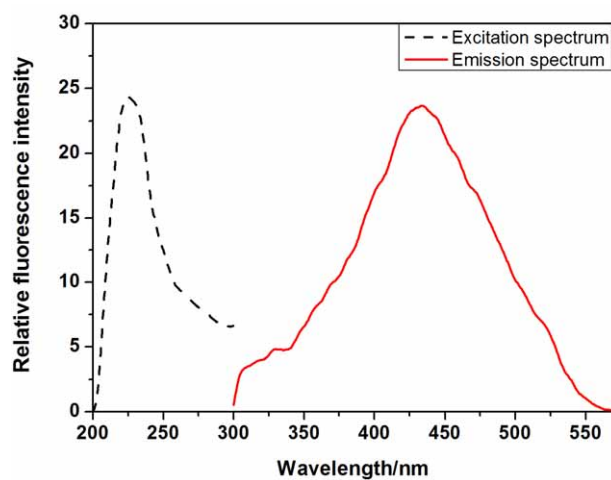
1. Figure S1: Raman spectrum of N-doped GO (12+12 h)



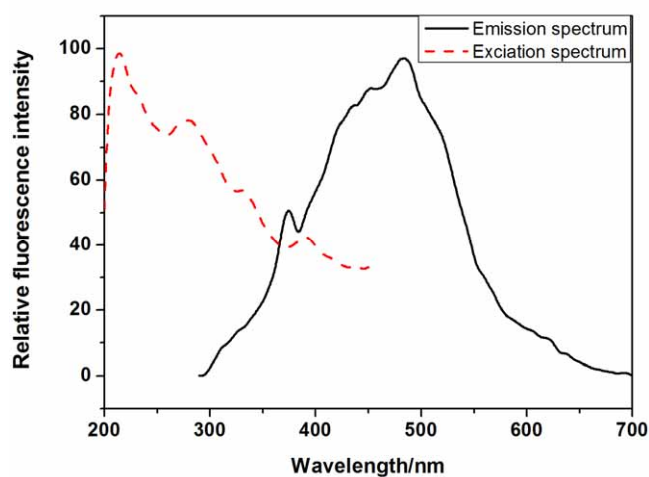
2. Figure S2: The excitation and emission spectra for S-NCNTs



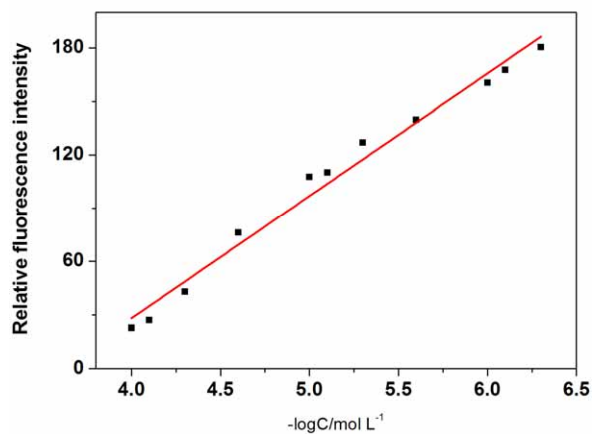
3. Figure S3: The excitation and emission spectra for N-doped GO (6+6 h)



4. Figure S4: The excitation and emission spectra for N-doped GO (12+12 h)



5. Figure S5: The plot of fluorescence vs concentration of Cd^{2+} with calibration curve



6. The experimental details.

Synthesis of N-doped carbon nanotubes (NCNTs). NCNTs with a nitrogen content of 3-5% were synthesized by chemical vapor deposition at 650 °C and pyridine was used as precursor. The as-prepared NCNTs were refluxed in 6 M NaOH and 6 M HCl aqueous solution at 100 °C for 4 h in turn to remove the Al₂O₃ support and metal catalysts respectively. The resulted NCNTs were washed with distilled water until the pH value of the filtrate reached to 7 and then dried at 80 °C overnight.

Oxidative treatment of NCNTs. 0.1 g of NCNTs were added in 10 ml of mixed acids (H₂SO₄:HNO₃, ratio 3:1), and then the resulting mixture was treated by sonication for 3 h. The products were washed by distilled water until the filtrate reaches to pH 7, and then dried at 100 °C. The obtained product were shortened and named as S-NCNTs. Another 0.1 g of NCNTs were added in 10 ml of mixed acids (H₂SO₄:HNO₃, ratio 3:1), and then the resulting mixture was treated by sonication for 6 h with an additional standing time of 6 h. After washing and drying, the obtained products were donated as N-doped GO (6+6 h). Another 0.1 g of NCNTs were added in 10 ml of mixed acids (H₂SO₄:HNO₃, ratio 3:1), and then the resulting mixture was treated by sonication for 12 h with an additional standing time of 12 h. After washing and drying, the obtained products were donated as N-doped GO (12+12 h).

Characterization of P-NCNTs, S-NCNTs and N-doped GO. The UV-Vis spectra were recorded on a PerkinElmer Lamda 950 spectrometer, in which the P-NCNTs were dispersed in 1% sodium dodecyl benzene sulfonate solution, and the others were dispersed in water. The Fourier transform infrared spectroscopy (FTIR) spectra were measured by a Thermo NEXUS 670 Fourier transform infrared spectrometer. Transmission electron microscopy (TEM) images were obtained by using a TEM-3100F transmission electron microscopy with accelerating voltage of 200 KV. The fluorescence measurements were performed on a PerkinElmer LS 55 spectrometer, in which the dispersions in water were used.

Determination of the quantum yields. Determination of the quantum yields of these oxidized produces was accomplished by comparison of the wavelength integrated intensity of these oxidized products to that of the standard quinine sulfate. The optical density is kept below 0.05 to avoid inner filter effects. The quantum yields of these oxidized products were calculated using

$$\Phi = \Phi_S [(I \cdot A_S)/(I_S \cdot A)]$$

where Φ is the quantum yield, I is the integrated intensity, A is the optical density. The subscript S refers to the standard reference of known quantum yield. In this work, quinine sulfate was chosen as the standard, whose quantum yield is 0.577.

Preparation of the solutions with additional ions. In order to eliminate the pH effect induced by metal ions, all the chosen ions solutions were adjusted to pH 1.0. The resulting ions solutions were added to the same amount of N-doped GO solutions respectively to obtain the series of mixed solutions, in which the concentrations of the ions in the mixed solutions keep identical. In all the mixed solutions, the concentration of N-doped GO was identical to raw solution with pure N-doped GO.