

# **Fast and facile preparation of graphene oxide and reduced graphene oxide nanoplatelets**

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## 1. FTIR analysis

Figure S1 shows FTIR spectra of graphite, GO samples prepared after oxidation for 2, 5, 10 min and reduced GO. The spectrum of GO illustrates the presence of C-O ( $\nu_{\text{C-O}}$  at  $1100\text{cm}^{-1}$ ) and C=O in carboxylic acid and carbonyl moieties ( $\nu_{\text{C=O}}$  at  $1650\text{cm}^{-1}$ ). The broad, intense band at  $3430\text{ cm}^{-1}$  can be attributed to O-H stretching vibrations. The peak at  $1450\text{ cm}^{-1}$  is from skeletal vibration of unoxidized graphitic domains. It can be found that with the increasing of oxidation time, the peaks of  $\nu_{\text{C-O}}$  and  $\nu_{\text{C=O}}$  become stronger. Moreover, after reduction, these two peaks disappeared. These results confirmed that GO has been well deoxygenated after reduction, which is consistent with the results of Raman (figure 2) and TGA (figure 3) analysis.

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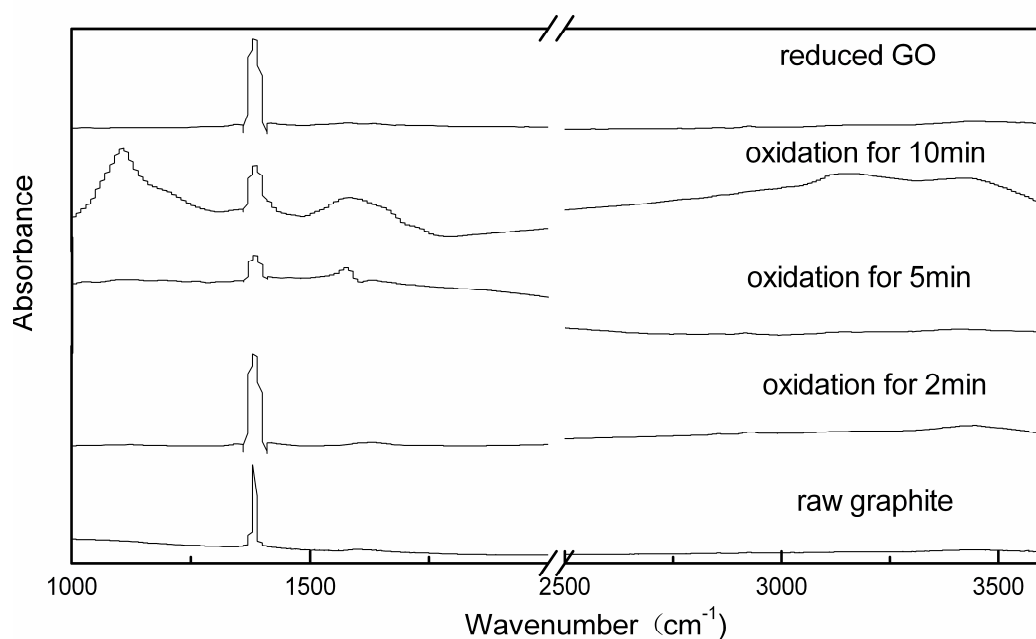


Figure S1. FTIR spectra of graphite, GO samples prepared after oxidation for 2, 5, 10 min and reduced GO

## 2. Parallel process under the same condition without O<sub>2</sub>

Control experiment under the same condition (oxidation for 10min) with N<sub>2</sub> atmosphere was done.

Figure S2 shows the FTIR results of the samples oxidized under O<sub>2</sub> and N<sub>2</sub> atmosphere, respectively.

It can be seen that the peaks of  $\nu_{\text{C-O}}$  at  $1100\text{cm}^{-1}$  and  $\nu_{\text{O-H}}$  at  $3400\text{ cm}^{-1}$  in the sample oxidized under N<sub>2</sub> atmosphere are much lower than that under O<sub>2</sub> atmosphere, suggesting that O<sub>2</sub> plays an important role in the production process.

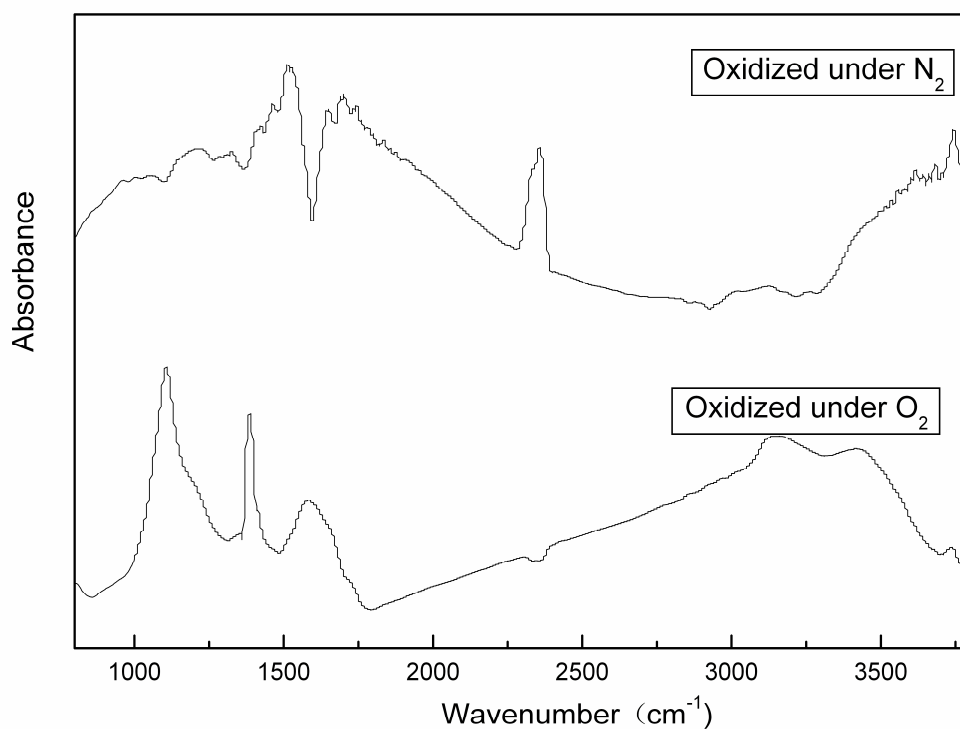


Figure S2. FTIR spectra of the samples oxidized under O<sub>2</sub> and N<sub>2</sub> atmosphere

Figure S3 shows the Raman results of raw graphite, samples oxidized under O<sub>2</sub> and N<sub>2</sub> atmosphere. It can be seen comparing with raw graphite, the ratio of the intensities ( $I_D/I_G$ ) for the sample oxidized under N<sub>2</sub> atmosphere is slightly increased, indicating the formation of a small part of sp<sup>3</sup> carbon by functionalization. However, compared with the sample oxidized under O<sub>2</sub> atmosphere, this effect is very low. This phenomenon confirms that O<sub>2</sub> plays an important role in the production process, which is consistent with FTIR results (figure S2).

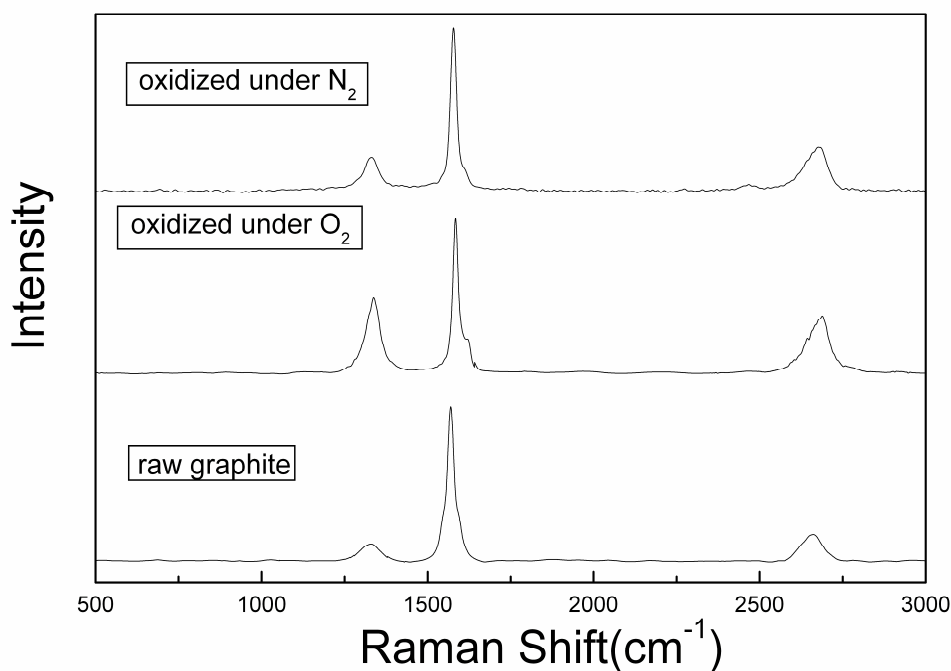


Figure S3 Raman results of raw graphite, samples oxidized under  $\text{O}_2$  and  $\text{N}_2$  atmosphere

### 3. Electrical conductivity analysis

The electrical resistance of the samples was measured by the four point probe method with a SB100A/2 specific resistance measuring apparatus (Shanghai Qian Feng Electrics Co., Ltd.). Generally, it is noteworthy that the conductivity of the samples varied in the order: reduced GO > raw graphite > GO (oxidized under  $\text{N}_2$ ) > GO (oxidized under  $\text{O}_2$ ). The conductivity of raw graphite is similar with that in reference 1 and 2, while the conductivity of GO (oxidized under  $\text{O}_2$ ) is higher than that in reference 1. Besides, the conductivity of reduced GO is a little higher than that in reference 3, confirming that prepared GO with our method can be highly reduced. Comparing the conductivities of GO (oxidized under  $\text{O}_2$ ) and GO (oxidized under  $\text{N}_2$ ), we can find that the latter is much higher, which also confirms that  $\text{O}_2$  plays an important role in the production process. This result is consistent with the results of FTIR and Raman analysis.

Table S1. Electrical conductivities of the samples

Sample name	Conductivity (S/m)
Raw graphite	39970
GO (oxidized under O <sub>2</sub> )	270.72
GO (oxidized under N <sub>2</sub> )	3660
Reduced GO	46081

#### 4. SEM images of raw graphite and GO samples

The investigation of the structure had been performed by scanning electron microscopy (SEM) using a Philips XL30 FEG FE-SEM at 25KV. Figure S4 shows SEM images of raw graphite and GO sample after 10min oxidation, with concentration of 0.1mg/mL. As oxidation proceeds, the roughness of the samples increased (figure S4b). The graphite changed from a densely layered morphology to an expanded and wrinkle structure, similar to what has been reported in the literature.<sup>4</sup> The image is distinguishable from pristine graphite by the appearance of bright regions lacking ordered lattice features. They most likely arise from the presence of oxygenated functional groups. In addition, the flakes lie flat on each other, suggesting good contact between each other. However, individual sheets are not formed due to incomplete exfoliation.

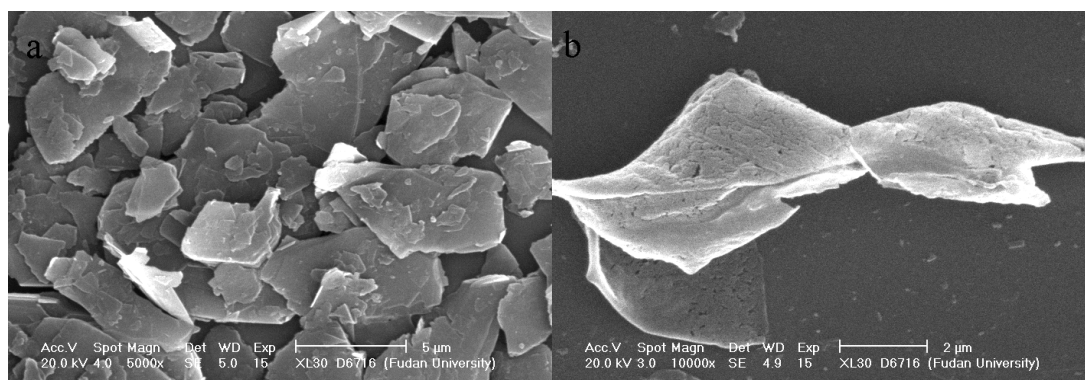


Figure S4. SEM images of raw graphite (a) and GO (b) after 10min oxidation at 100W, with concentration of 0.1mg/mL.

#### 5. AFM image of GO under low ultrasonication power

Figure S5 shows the AFM image of GO under low ultrasonication power (100W for 0.5h). It can be found that comparing with the result of Figure 7 (with higher ultrasonication power), it is larger (about 500nm) and thicker (>2nm). This phenomenon is consistent with the report in literature 5, confirming that the ultrasonication power has an effect on the size of the samples.

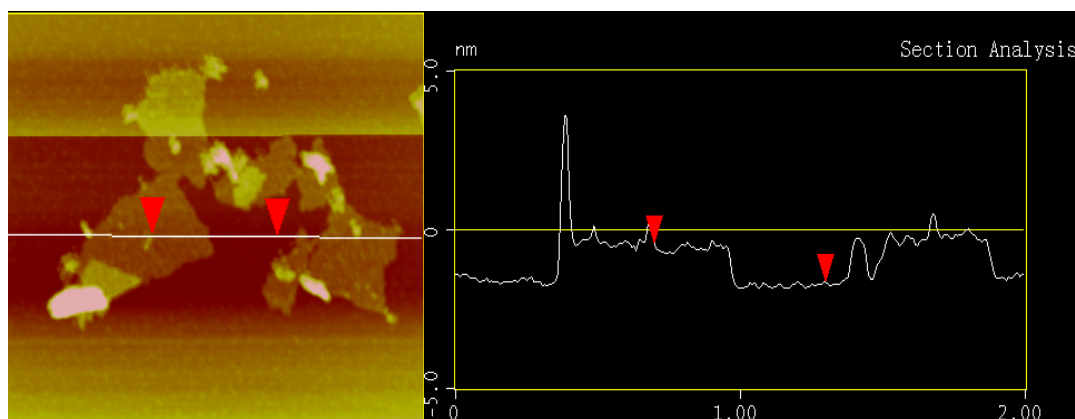


Figure S5 AFM images of GO (100W for 0.5h; Image dimension is 2  $\mu\text{m}$   $\times$  2  $\mu\text{m}$ )

#### 6. UV/Vis analysis of spectra of GO samples prepared after 10 min oxidation

Figure S6 shows the UV/Vis spectra of GO samples prepared after 10 min oxidation at different concentrations taken after 3h when the solutions had been sonicated for 10min (100W). It can be found that the absorbance increased with the concentration. From figure S6b, we can clearly see that the data obey the Beer's law, which is consistent with the results reported in the literature.<sup>6</sup>

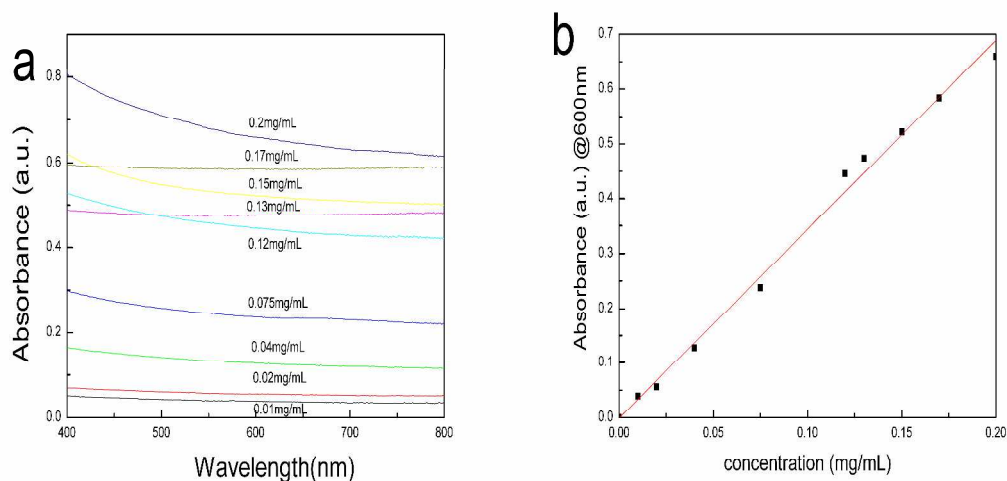


Figure S6. UV/Vis spectra (a) of GO samples prepared after 10 min oxidation at different concentrations taken after 3h after the solution had been sonicated for 10min. (b) The absorbance at 600nm versus the concentration. The line is linear least-squares fit to the data.

## References

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