

# Supplementary Information

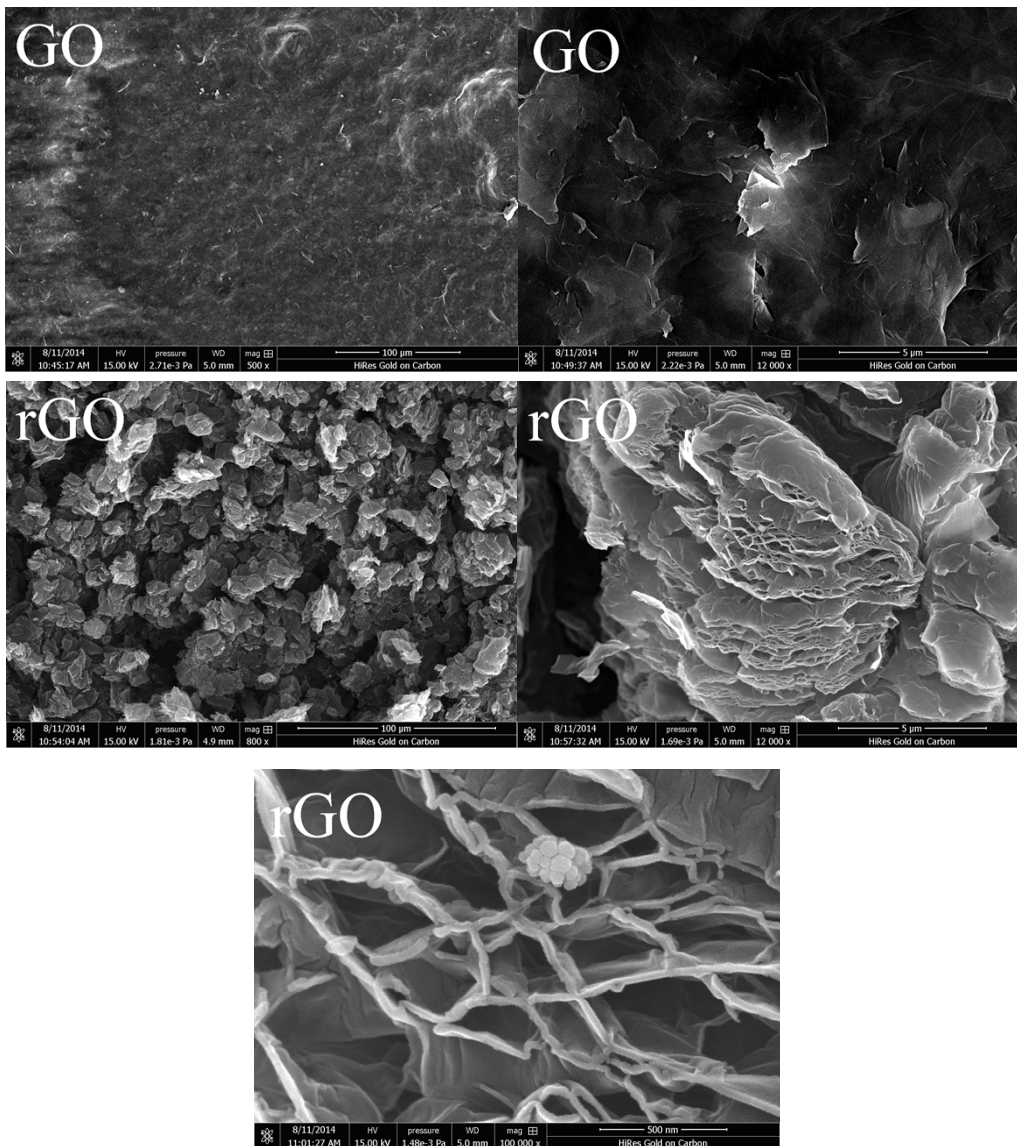
## **Rapid production of a bulk of porous mesh reduced graphene oxide films by a naked flame**

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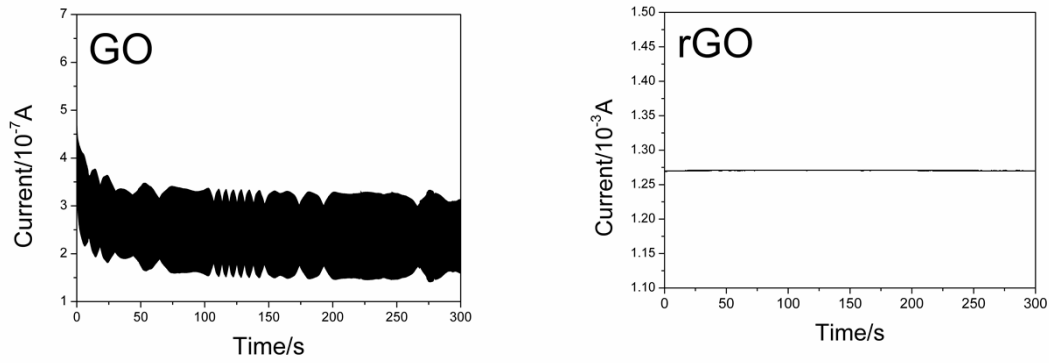
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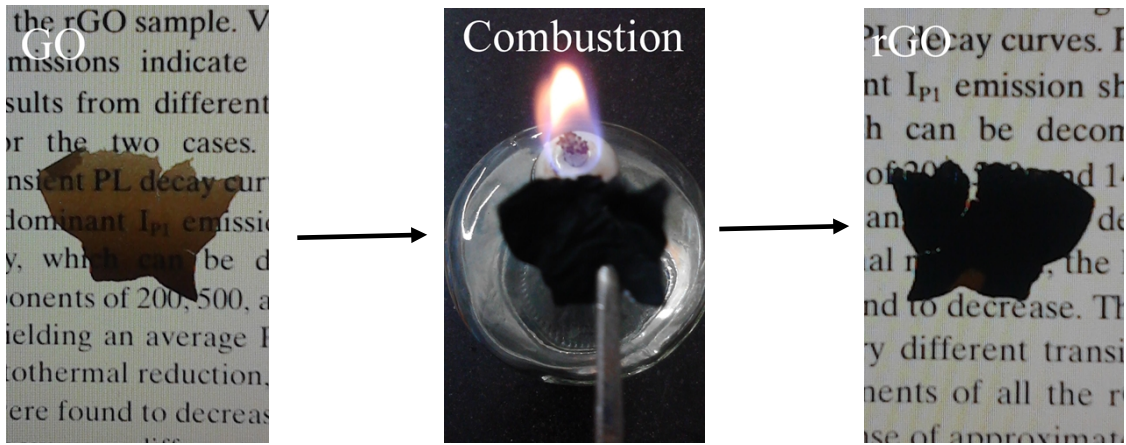
**Fig. S1** SEM images of GO films and rGO films.

**Fig. S2** Cross-sectional SEM images of GO films.



**Fig. S3** Current-time curves of GO films and rGO films. The current-time curves were carried out in the voltage of 6V for 300s.

As shown in Fig. S3, the current with the time prolonged, in the GO films presenting a large fluctuation, and in the rGO films showing a constant value, was observed. This indicates the chemical properties of GO films are not stable, in comparison with rGO films. We get an average value of the current (GO films with  $2.5 \times 10^{-7}$  A, rGO films with  $1.27 \times 10^{-3}$  A) to calculate the resistance of GO films and rGO films, corresponding to about  $24 \text{M}\Omega$  and  $\sim 4.7 \text{k}\Omega$ , respectively. This illuminates the conductivity of rGO films is obviously improved.



**Fig. S4** The process of preparation of rGO films. The rGO films were obtained instantaneously when the GO films passed through the flame.



**Fig. S5** Resistances of GO films and rGO films observed by a multimeter.

**Fig. S6** (1) UV-vis absorption spectra of the absorption of MB in 60 min, and the removal of MB with 30 min of UV light irradiation. (2) The discoloration of the absorption of MB in 60 min (a), and the discoloration of the MB with 30min of UV light irradiation (500 W Hg lamp) (b).

**Fig. S7** Representative N<sub>2</sub> absorption/desorption isotherms of rGO films, which corresponds to a BET surface area of about 370 m<sup>2</sup>/g.

**Table S1.** A comparison of the as-reported researches about the absorption and photocatalysis.

Materials	Preparation conditions	Contamination	Removal capacity ((m <sub>contamination</sub> /m <sub>catalyst</sub> ) / degradation time)	Ref.
Graphene-ZnO	95 °C, 5 h	Rhodamine-B	0.0001/70 min	[2]
TiO <sub>2</sub> /graphene	210 °C, 24 h	Rhodamine-B	0.014/90 min	[3]
TiO <sub>2</sub> /GO	80 °C, 24 h	Quinoline	0.034/180 min	[4]
α-Fe <sub>2</sub> O <sub>3</sub>	180 °C, 36 h	Phenol	0.007/120 min	[5]
Nanorod/rGO				
BiVO <sub>4</sub> -rGO	180 °C, 12 h	Methyl blue and rhodamine-B	0.0094/70 min and 0.009/70 min	[6]
Graphene/TiO <sub>2</sub>	120 °C, 24 h	Methylene blue	0.24/150 min	[7]
ZnO - rGO	100 °C, 30 min	Methylene blue	0.0029/280 min	[8]
GO - Fe <sub>2</sub> O <sub>3</sub>	60 °C, 8 h	Rhodamine-B	0.0099/95 min	[9]
Graphene-γ-Fe <sub>2</sub> O <sub>3</sub>	N <sub>2</sub> H <sub>4</sub> /90°C/20 h	Endocrine-disrupting compounds	0.2/12 h	[10]
rGO films	Flame	Methylene blue	0.28/90 min	Here

### Synthesis of graphite oxide

Graphite oxide was obtained from natural flake graphite by a modified Hummers method.<sup>1</sup> In an ice-water bath, a Teflon-coated magnetic stir bar, 1g of natural flake graphite, 0.5 g of sodium nitrate, and 23 mL of concentrated H<sub>2</sub>SO<sub>4</sub> were placed to a 250 mL of round-bottom flask. After stirring for 30 min, 3 g of KMnO<sub>4</sub> was added slowly. Sequentially, the system was heated for 30 min at 35 °C, 50 mL of distilled

water was added gradually, and the mixture was stirred for 15 min at 98 °C. In the end, the mixture was diluted with 140mL of distilled water, and approximate 10mL 30% of H<sub>2</sub>O<sub>2</sub> solution, after which the color of the mixture changed to luminous yellow. The mixture was centrifuged and washed with 500 mL 5% of HCl aqueous solution five times, and distilled water several times to remove metal ions, and the acid, respectively. The product was dried at 50°C for 24 h.

### **Preparation of graphene oxide (GO) films**

To obtain a large scale of GO films fast, a novel and simple method was developed. 0.1 g of graphite oxide was dispersed into the ethanol by sonication for 1 h.<sup>1</sup> The obtained dispersion was placed to a round-bottom flask, and the ethanol was slowly removed by a rotary evaporator. After that, a mass of GO films were formed, when the ethanol was fully removed.

### **Preparation of reduced graphene oxide (rGO) films**

rGO film was prepared by a naked flame from a alcohol lamp, as shown in Fig. S4. GO films were quickly passed through a naked flame from a burning alcohol lamp (a color change from yellow-brown to black), as well as a black and rough films were obtained.

### **Physical measurements**

Fourier Transform infrared spectroscopy (FT-IR) was obtained as KBr disks on a Germany Bruker Tensor 27 spectrometer from 4000 to 400 cm<sup>-1</sup>. FEI NanoSEM 450 was introduced to observe the morphology and microstructure, and Energy dispersive X-ray analysis was also carried out by the FEI NanoSEM 450. Transmission electron microscopy (TEM) image was performed on a FEI NanoSEM 450. X-ray diffraction (XRD) patterns in the range of 5-90° was obtained by a Bruker AX (Germany). Thermogravimetric analysis (TGA) was carried out in in temperature range of 30-600 °C under N<sub>2</sub> atmosphere at the heating rate of 10 °C min<sup>-1</sup>. Chronoamperometry (CA), and electrochemical impedance spectroscopy (EIS) was implemented to obtain the

current-time curve by an electrochemical workstation (CHI600D) in the voltage of 6 V for 300 s. The content of the materials was recorded by X-ray photoelectron energy spectra (XPS) (K-alpha) with Al K $\alpha$  radiation.

## References:

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