

# Supporting Information

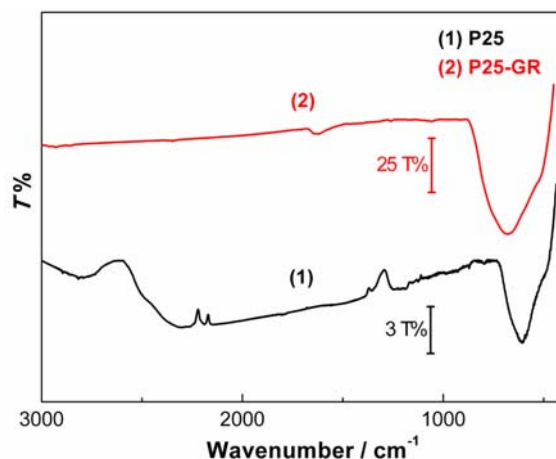
## P25-Graphene Composite as a High Performance Photocatalyst

*Hao Zhang, Xiaojun Lv, Yueming Li, Ying Wang and Jinghong Li\**

Department of Chemistry, Key Laboratory of Bioorganic Phosphorus Chemistry &  
Chemical Biology, Tsinghua University, Beijing 100084, China;

Email: jhli@mail.tsinghua.edu.cn

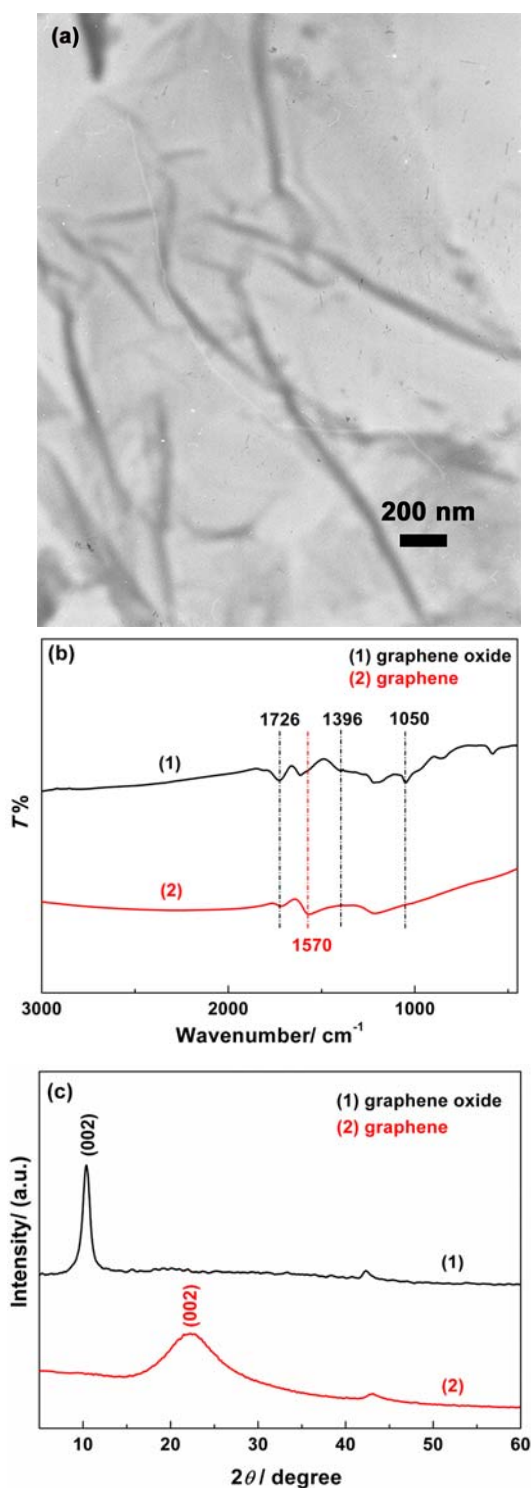
1) Magnification of FTIR spectra of P25 and P25-GR in the range of 3000-450  $\text{cm}^{-1}$ .



**Figure S1** FTIR spectra of (1) P25 and (2) P25-GR with different magnifications in the range of 3000-450  $\text{cm}^{-1}$ .

Figure S1 shows the FTIR spectra of P25 and P25-GR in the range of 3000-450  $\text{cm}^{-1}$  with different magnifications. After the introduction of graphene, the absorption peak corresponding to Ti-O-Ti of  $\text{TiO}_2$  P25 shifted to higher wavenumber. The shift was attributed to the combination of the vibration of Ti-O-Ti and Ti-O-C bonds.<sup>1</sup> The FTIR results confirmed the formation of Ti-O-C bonds between P25 and graphene during the hydrothermal reaction.

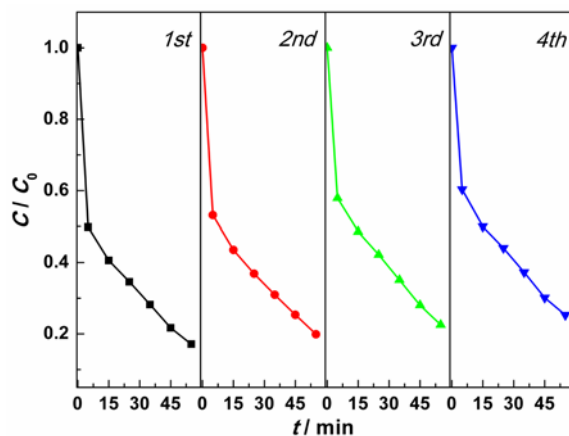
2) Characterization of graphene obtained via hydrothermal reduction of graphene oxide.



**Figure S2** (a) Typical TEM image of graphene obtained via hydrothermal reduction. (b) FTIR spectra of (1) graphene oxide and (2) as prepared graphene. (c) XRD patterns of (1) graphene oxide and (2) as prepared graphene.

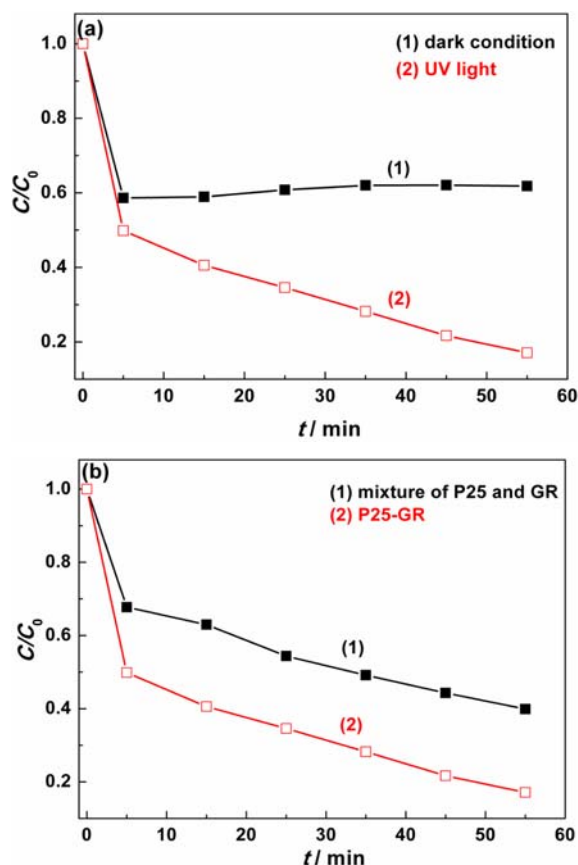
Figure S2a shows the typical TEM image of graphene prepared via the hydrothermal reduction of graphene oxide at 120 °C for 3 h. The as prepared graphene maintained the two dimensional sheet structure with some wrinkles of micrometers long. Figure S2b shows the FTIR spectra of graphene oxide (GO) and as-prepared graphene. In GO (curve 1), the absorption due to C=O stretching of COOH groups situated at the edge of GO sheets was observed at about 1726 cm<sup>-1</sup>. The peak at around 1620 cm<sup>-1</sup> was assigned to the O-H bending. The absorption peaks at 1396 cm<sup>-1</sup> and 1050 cm<sup>-1</sup> were attributed to the tertiary C-OH and C-O stretching mode, respectively. While in curve 2, the absorption peaks for the O-H bending, tertiary C-OH and C-O stretching were absent. The C=O stretching (1726 cm<sup>-1</sup>) decreased a lot in intensity and the absorption band that appeared at *ca.* 1570 cm<sup>-1</sup> clearly showed the skeletal vibration of the graphene sheets.<sup>2</sup> These results confirmed the reduction of GO sheets to graphene with a small amount of residual carboxylic acid groups. Figure S2c are the XRD patterns of GO and graphene. GO had a peak centered at 2 $\theta$ =10.4°, corresponding to the (002) inter-planar spacing of *ca.* 9 Å. After hydrothermal reaction, GO was reduced to graphene sheets, verified by the characteristic peak at around 24.7°.<sup>3</sup>

3) Cycling Runs in the Photodegradation of Methylene Blue by P25-GR under UV Light.



**Figure S3** Cycling runs in the photodegradation of methylene blue in the presence on P25-GR under UV light, P25-GR (0.75 g/L); addition of methylene blue ( $2.7 \times 10^{-5}$  M, 40 mL, per run).

4) Control experiments in the photodegradation of MB dyes over P25-GR.



**Figure S4** (a) Photodegradation of MB over P25-GR (1) in dark and (2) under UV light irradiation. (b) Photodegradation of MB under UV light irradiation over (1) physical mixture of P25 and as prepared graphene (with carbon content of 1 wt%) and (2) P25-GR obtained by hydrothermal method. In each experiment, 30 mg catalyst was dispersed in 40 mL MB solution ( $2.7 \times 10^{-5}$  M).

## Reference:

- (1) Sakthive, S.; Kisch, H. *Angew. Chem. Int. Ed.* **2003**, *42*, 4908.
- (2) Xu, Y.X.; Bai, H.; Lu, G.W.; Li, C.; Shi, G.Q. *J. Am. Chem. Soc.* **2008**, *130*, 5856.
- (3) Wang, Y.; Li, Y.M.; Tang, L.H. Lu, J.; Li, J.H. *Electrochem. Comm.* **2009**, *11*, 889.