Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Significant enhancement in photocatalytic activity of high quality SiC/graphene core-shell heterojunction with optimal structural parameters

Wei Lu, Liwei Guo,* Yuping Jia, Yu Guo, Zhilin Li, Jingjing Lin, Jiao Huang, Wenjun Wang

Research & Development Center for Functional Crystals, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, P.O. Box 603, Beijing 100190, China

*Corresponding author:

Tel: +86 10 82649453; Fax: +86 10 82649646. E-mail addresses: lwguo@iphy.ac.cn.

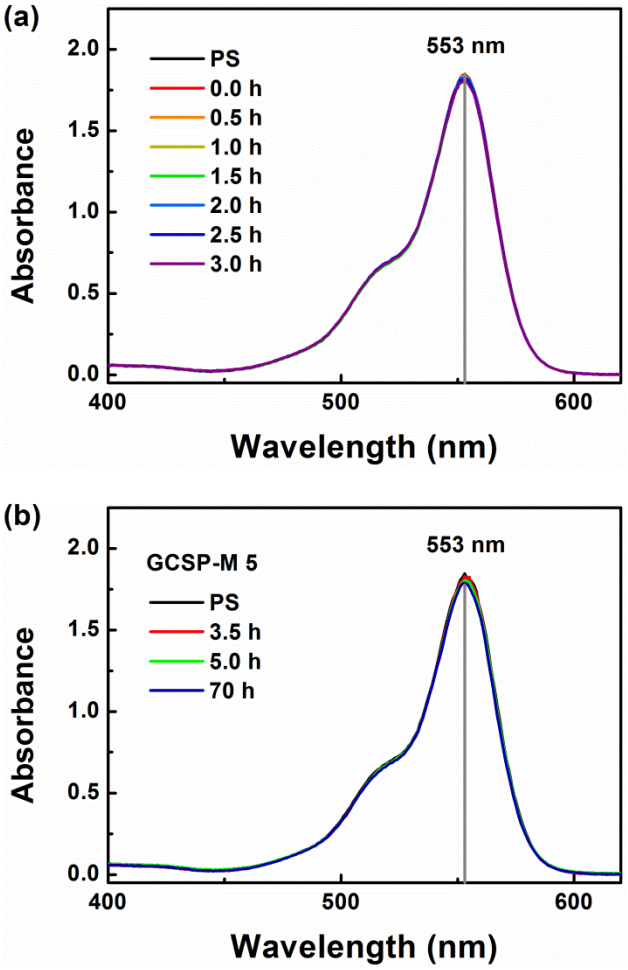

Figure S1. Absorption spectra of RhB in blank experiments, (a) During 3 hours UV irradiation without any catalyst, (b) The RhB suspension with 1 mg/mL GCSP-M in size of 5 μm in dark for different times, where PS denotes the as prepared parent solution of RhB.

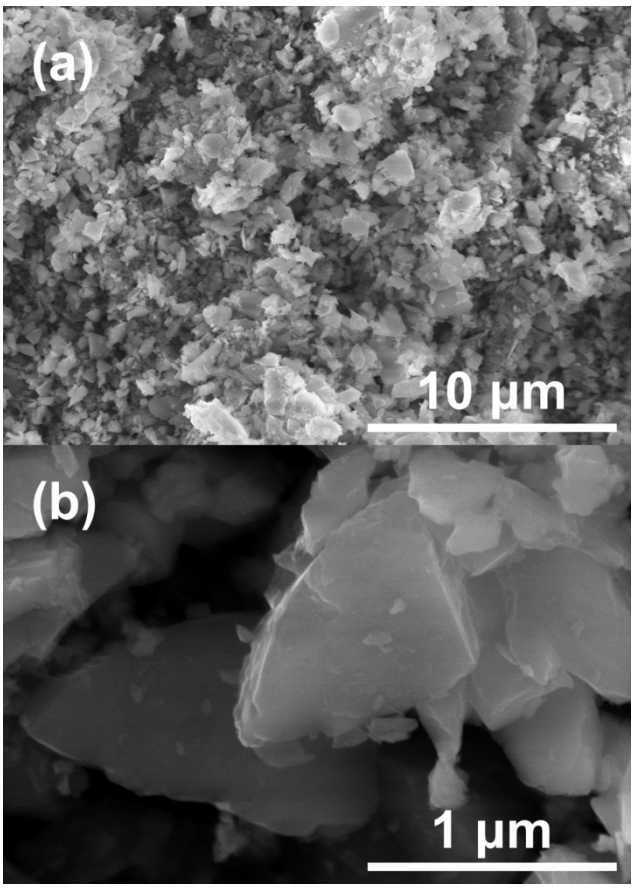

Figure S2. SEM images of 1.0 wt % RGO/SiC composite (a) and its magnified image (b).

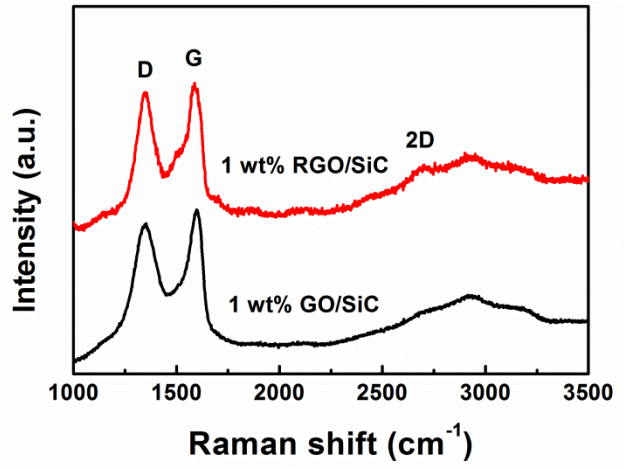

Figure S3. Raman spectra of 1.0 wt % GO/SiC (black) and 1.0 wt % RGO/SiC (red) composites.

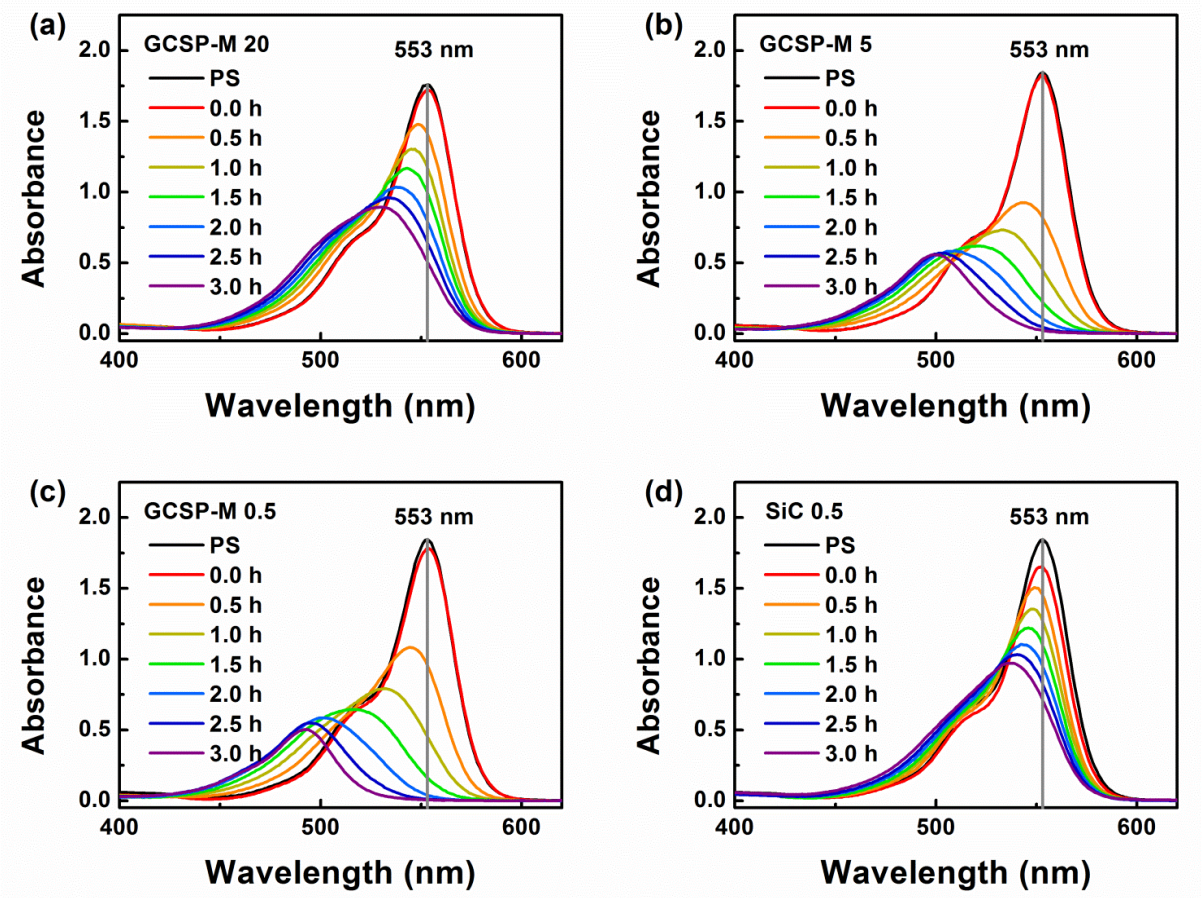

Figure S4. Absorption spectra of RhB after 365 nm UV photodegradation in duration 0~3 hours using the catalysts of GCSP-M derived from the SiC powder in sizes of 20, 5 and 0.5 μm respectively shown in (a)-(c) and the pristine SiC powder in size of 0.5 μm shown in (d), where PS denotes the parent solution of RhB without any catalyst.

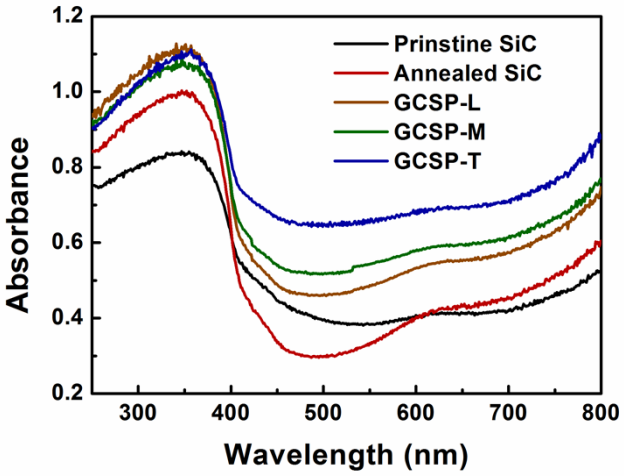

Figure S5. Diffuse reflectance absorption spectra of five kinds of SiC powder in size of 20 μm, they are pristine SiC powder, the annealed SiC powder and three GCSPs in different graphene thicknesses.

In Figure S5, it is noted that with high temperature annealing, the absorbance in 400~600 nm is clear lower than the pristine SiC, due to the reduction of impurities which contribute additional absorption. The absorbance in almost full range increases with the graphene thickness due to the uniformity absorption of graphene in wide wavelength range, which is determined by its zero band gap. The up-shift of the absorbance curve makes a gloss of red-shifting of the absorption edge. The absorbance of samples with high temperature treatment is higher in short and long wavelength and their absorption edges are sharper and in same slope. This is ascribed to higher crystallinity and less defects of the annealed SiC particles.

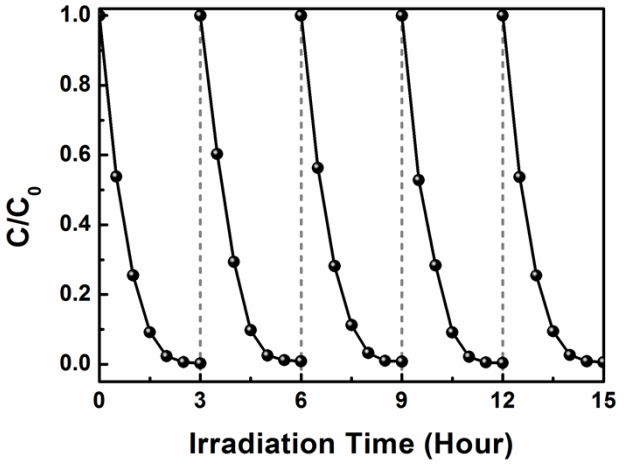

Figure S6. Catalyst recycle over 15 hours in photodegradation RhB by the GCSP-M derived from 0.5 μm SiC powder.

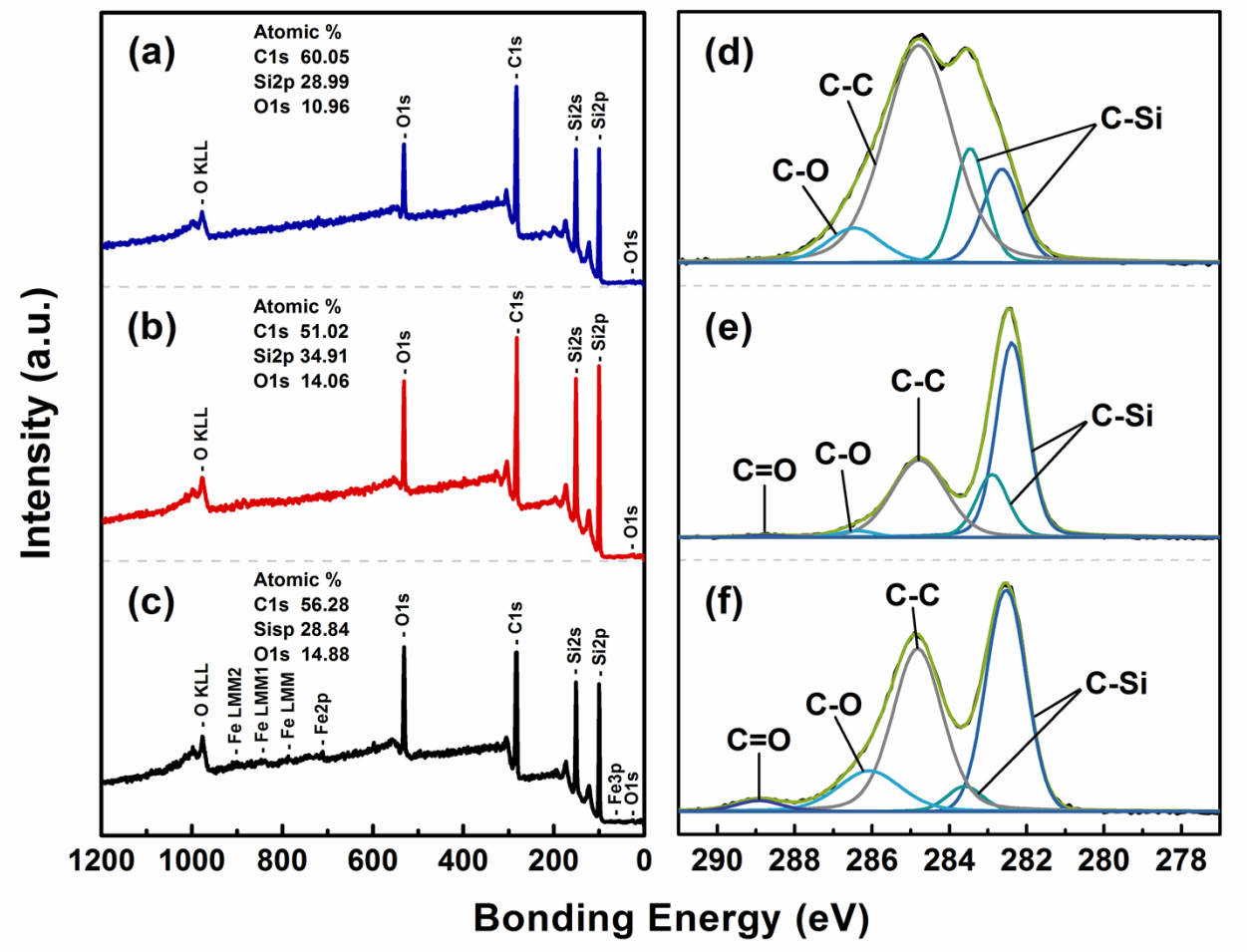

Figure S7. Wide-scan XPS patterns of (a) the GCSP-M, (b) the annealed SiC powder without graphene growth and (c) pristine SiC powder, and their corresponding C 1s photoelectron spectra in (d)-(f) respectively. The words in the figures indicate the XPS signals from the related atoms, their bonding and approximate content.

In Figure S7, all the samples are in size of 5 μm. The XPS spectra clearly show that the impurity peaks concerned with C and O in pristine SiC powder are reduced evidently and the trace of Fe related is completely eliminated after high temperature treatment. With graphene formation on surface of SiC particle, the C-C peak is obviously enhanced in the XPS spectrum of GCSP-M.

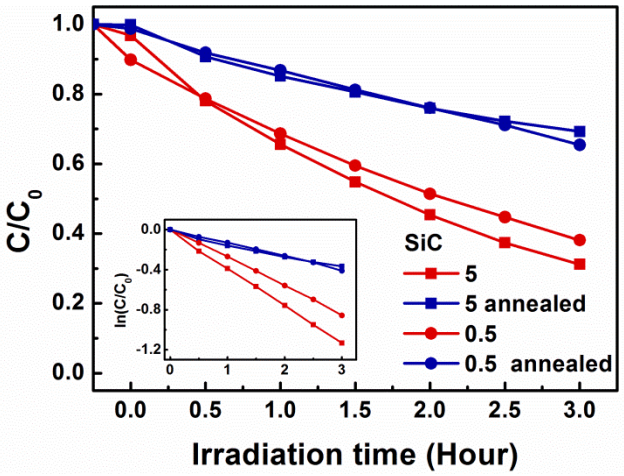

Figure S8. Time profiles of RhB photodegradation with the 5 μm, 0.5 μm pristine SiC powder respectively and their contrasts annealed at high temperature without graphene grown. The inset is the first order kinetic reaction profile of the corresponding SiC powder.

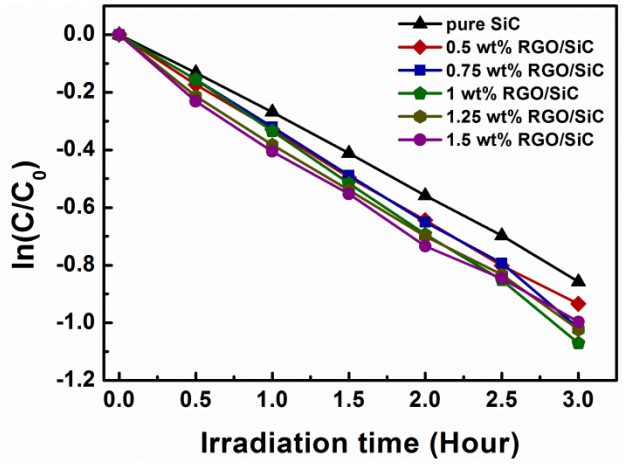

Figure S9. The first order kinetic reaction profiles of photodegradation RhB by RGO/SiC composites with RGO weight ratio to the SiC powder changed from in 0.5% to 1.5%, together with the pure SiC.