

Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Strategies for preparing TiO₂/CuS nanocomposites with cauliflower-like protrusions for photocatalytic water purification

Sihui Huang, Chuanxiang Qin*, Linyan Niu, Jianjun Wang, Jun Sun and Lixing Dai*.

College of Chemistry, Chemical Engineering and Materials Science, Soochow University, Suzhou 215123, China. E-mail: qinchuanxiang@suda.edu.cn, dailixing@suda.edu.cn

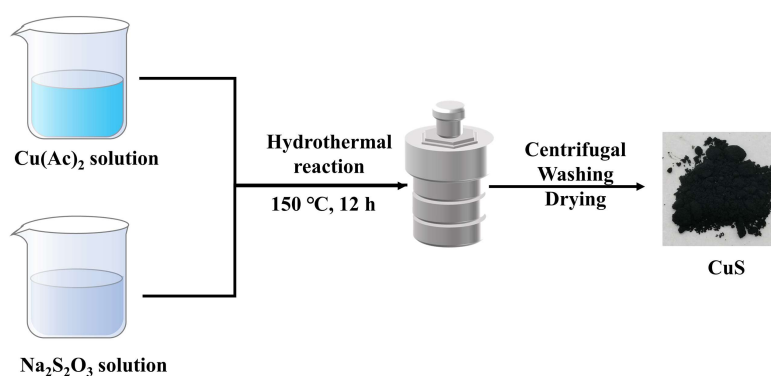


Fig. S1. The scheme of preparation process for CuS control.

Fig.S1 illustrates the preparation process for CuS control. Cu(Ac)₂·H₂O (6.75 mmol) was dissolved in deionized water (30 mL), and Na₂S₂O₃·5H₂O (6.75 mmol) was dissolved in deionized water (30 mL). The latter was slowly added to the former solution, and obtained in a light green turbid liquid. The mixed solution was transferred to 100 mL Teflon-lined stainless-steel autoclave and heated at 150 °C for 12 h. After the hydrothermal reaction, the temperature was lowered naturally, and the precipitate was removed out and centrifuged, washed with deionized water and ethanol for three times, and then dried in an oven at 60 °C for 12 h. to obtain CuS powder.

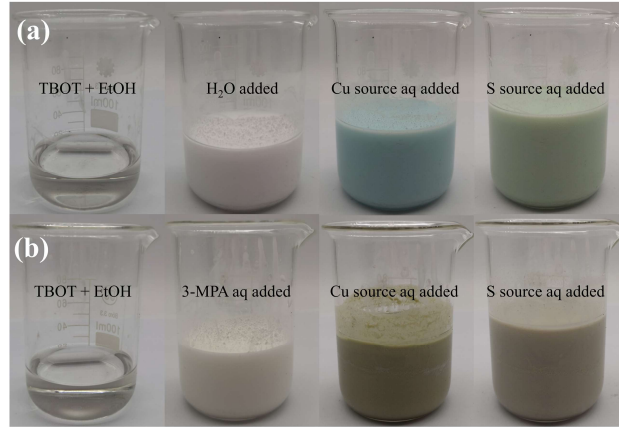


Fig. S2. The photographs of intermediates during the preparation of (a)TiO₂-CuS (sample prepared without 3-MPA), and(b) the target TiO₂/CuS.

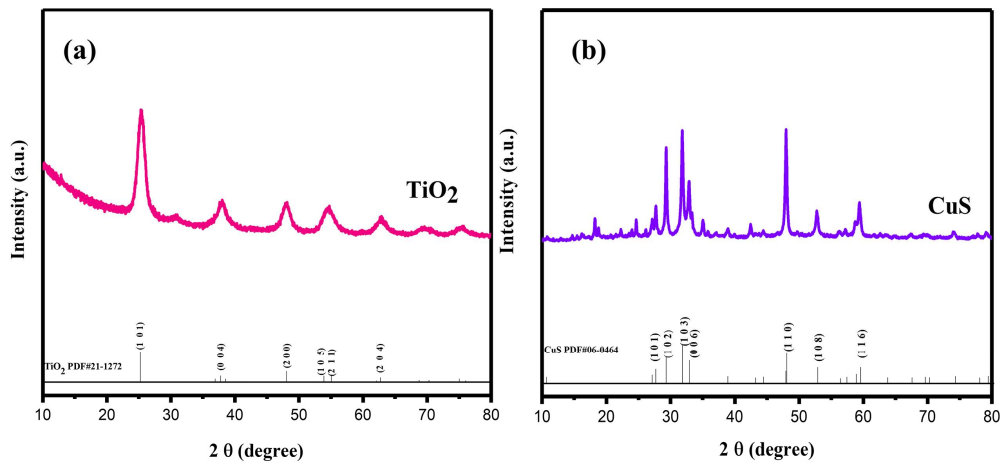


Fig. S3. XRD patterns of TiO₂ and CuS controls.

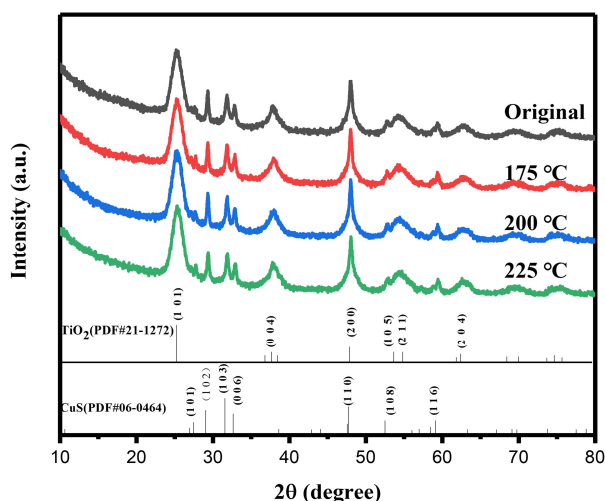


Fig. S4. XRD patterns of as-prepared TiO_2/CuS -20% using hydrothermal reaction (150 °C) and samples when the former was calcinated at different temperature (175 °C, 200 °C, 225 °C) in Ar for 3 h.

The specific surface area of the sample was measured by specific surface and pore size analyzer (BSD 3H-2000PS1, China). Before the test, the sample was degassed for 1 h in a vacuum environment at 120°C. After that, the specific surface area of the sample was measured by multi-point method.

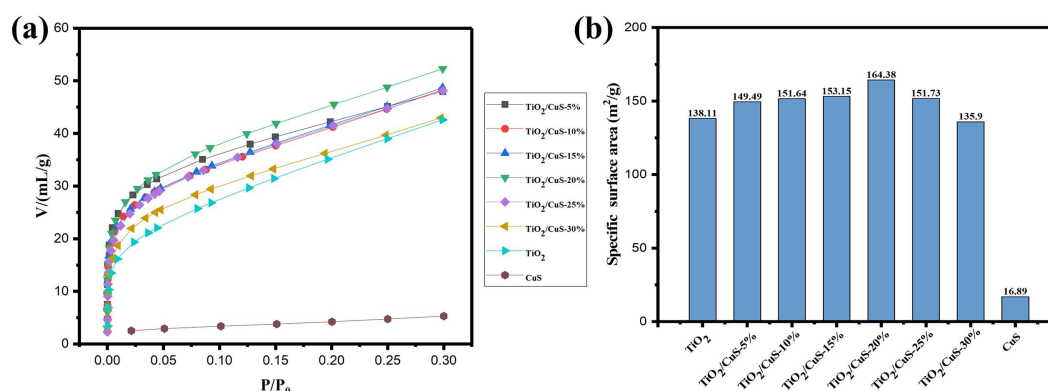


Fig. S5. Adsorption isothermal curves of TiO_2 , CuS and TiO_2/CuS nanocomposites with different mole ratios using BET multipoint surface area test and (b) their specific surface area.

Table. S1. Comparison table on the Specific surface area of TiO₂/CuS-20% with heterojunction materials which composites of TiO₂ and CuS in different researches.

Sample name	Application	Specific surface area m ² /g	Ref
CuS@TiO ₂ (1:10)		64.2	1
CuS@4TiO ₂	Hydrogen production	17.88	2
0.48-CuS/TiO ₂	Photoreduction	16	3
CuS/TiO ₂ NTAs	Photodegradation	13.5	4
CuS/TiO ₂ nanofibers	Photodegradation	38.01	5
CT _{0.4}	Hydrogen production	35	6
TiO ₂ -CuS-b	Photodegradation	37.4	7
TCNBs-0.1	Photodegradation	67.34	8
TiO ₂ /CuS-20%	Photodegradation	164.38	This work

Zeta potential tests were carried out on the samples by using MASTERSIZER laser particle size analyzer (Malvern Instruments Co.,LTD. UK). Deionized water was used as the dispersion solution of the samples during the test process, each sample was tested for three times and the average of test results was taken.

Table S 2. Zeta potential of different samples

Sample	TiO ₂	CuS
Zeta potential (mV)	10.57	-12.83

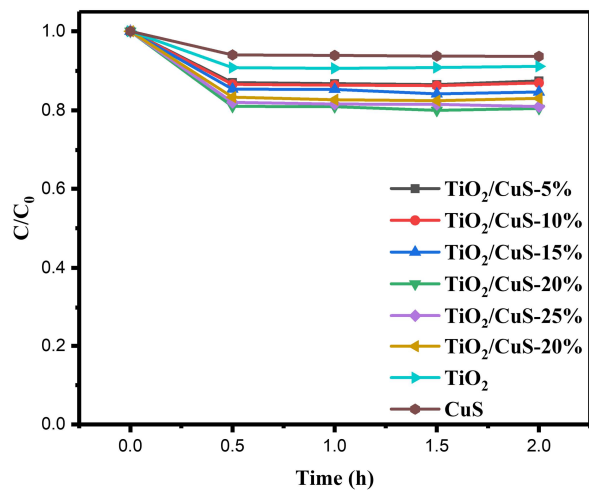


Fig. S6. The concentration changes of RhB aqueous solution with the presents of TiO₂, CuS and TiO₂/CuS with different mole ratio in dark condition

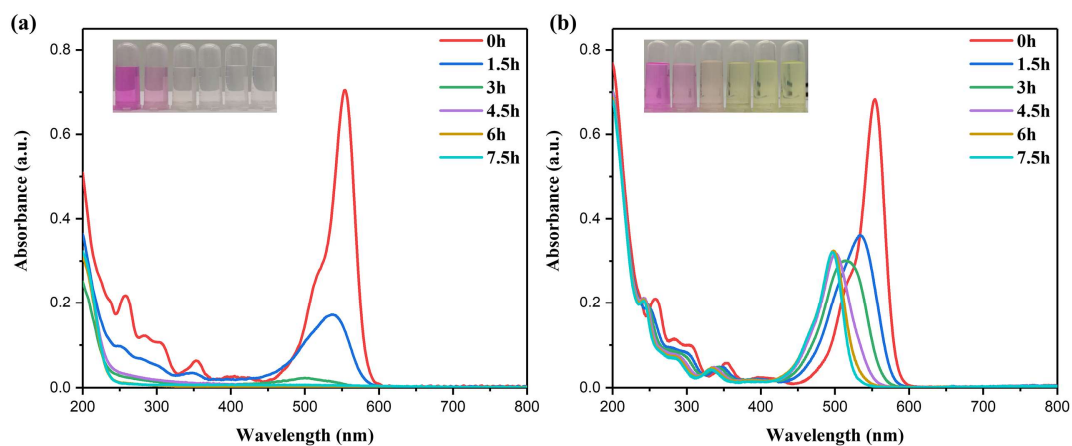


Fig. S7. UV-vis absorption spectra of RhB aqueous solutions with photocatalysts TiO₂/CuS-20% under different light conditions (a) Xe lamp light and (b) Visible light

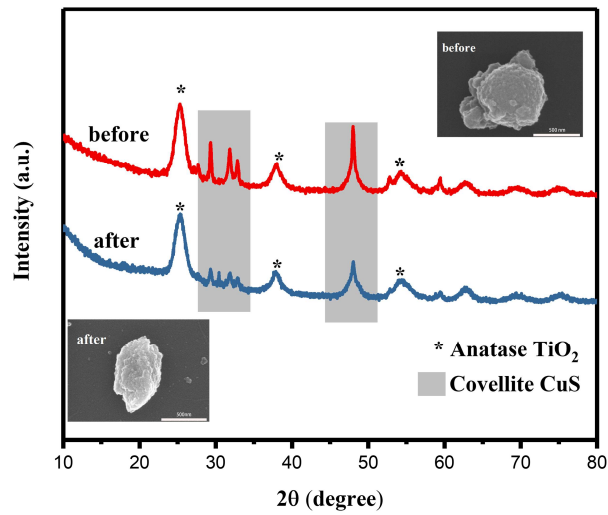


Fig. S8. SEM images and XRD patterns of TiO₂/CuS-20% samples before and after five photocatalytic reaction cycles.

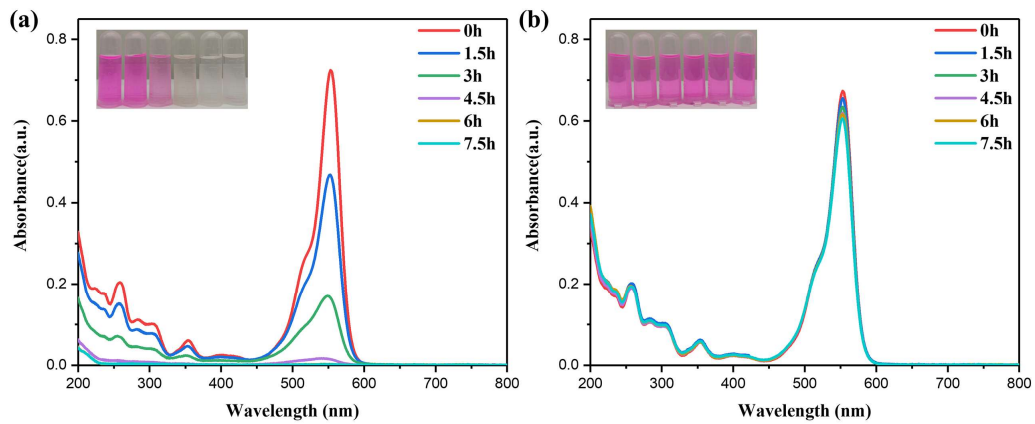


Fig. S9. UV-vis absorption spectra of RhB aqueous solutions with photocatalysts TiO₂-CuS-20% (sample prepared without 3-MPA) under different lighting conditions (a) Xe lamp light and (b) Visible light.

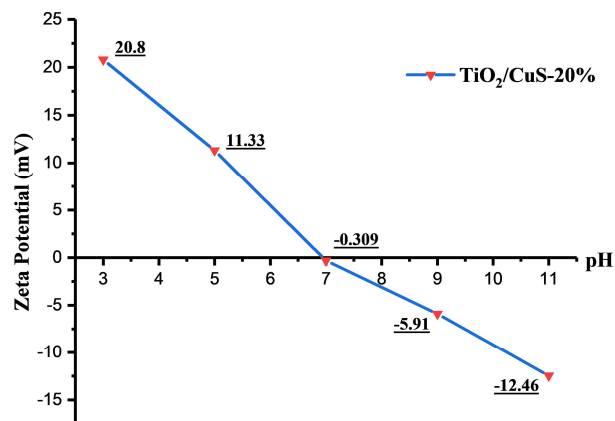


Fig.S10. Zeta potential distributions of the TiO₂/CuS-20% according to the pH.

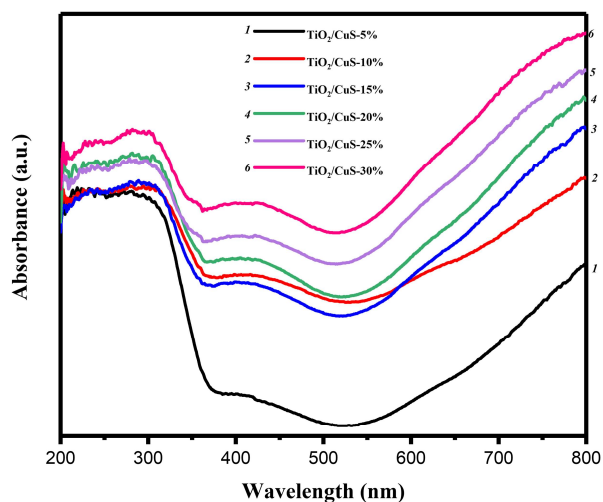


Fig. S11. UV-Vis DRS of TiO₂/CuS nanocomposites with different mole ratio.

Reference:

- 1 Y. Im, B. S. Kwak and M. Kang, *Powder Technol.*, 2014, **267**, 103-110.
- 2 Y. Im, S. Kang, K. M. Kim, T. Ju, G. B. Han, N.-K. Park, T. J. Lee and M. Kang, *Int. J. Photoenergy*, 2013, **2013**, 1-10.
- 3 Z. Wu, X. Liu, C. Yu, F. Li, W. Zhou and L. Wei, *Sci. Total Environ.*, 2021, **796**, 148941.
- 4 Q. Ma, H. Zhang, R. Guo, B. Li, X. Zhang, X. Cheng, M. Xie and Q. Cheng, *Electrochim. Acta*, 2018, **283**, 1154-1162.
- 5 G. Hou, Z. Cheng, L. Kang, X. Xu, F. Zhang and H. Yang, *CrystEngComm*, 2015, **17**, 5496-5501.
- 6 M. Chandra, K. Bhunia and D. Pradhan, *Inorg. Chem.*, 2018, **57**, 4524-4533.
- 7 S. Yu, J. Liu, Y. Zhou, R. D. Webster and X. Yan, *ACS Sustainable Chem. Eng.*, 2017, **5**, 1347-1357.
- 8 B. Yu, F. Meng, T. Zhou, A. Fan, M. W. Khan, H. Wu and X. Liu, *Ceram. Int.*, 2021, **47**, 8849-8858.