Electronic Supporting Information

Kilogram-scale fabrication of TiO_2 nanoparticles modified by carbon dots with enhanced visible-light photocatalytic activity

Jingjing Xu,[‡ a] *Jiayan Zhang,*[‡ a] *Feifei Tao,*[*ab] *Pengfei Liang,*[a] *and Pingan Zhang*[a]

[a] Department of Chemistry and Chemical Engineering, Shaoxing University, Zhejiang 312000, P. R. China

[b] Shanghai Advanced Research Institute, Chinese Academy of Sciences, Shanghai 201210, P. R. China

[‡] These authors contribute equally to this paper and should be considered as co-first author.

[*] Correspondence: feifeitao@usx.edu.cn; Tel.: +86-575-88342505

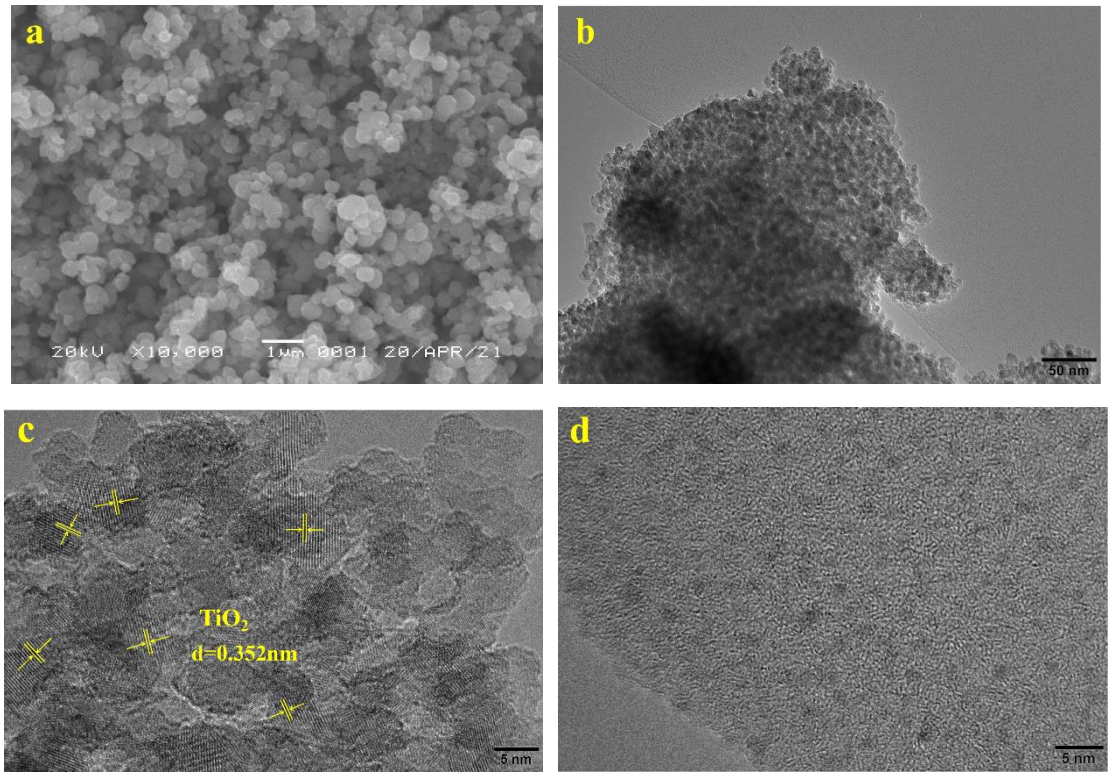

Fig. S1 SEM (a) and HRTEM (b-d) images of TiO_2 NPs (a-c) and CDs (d).

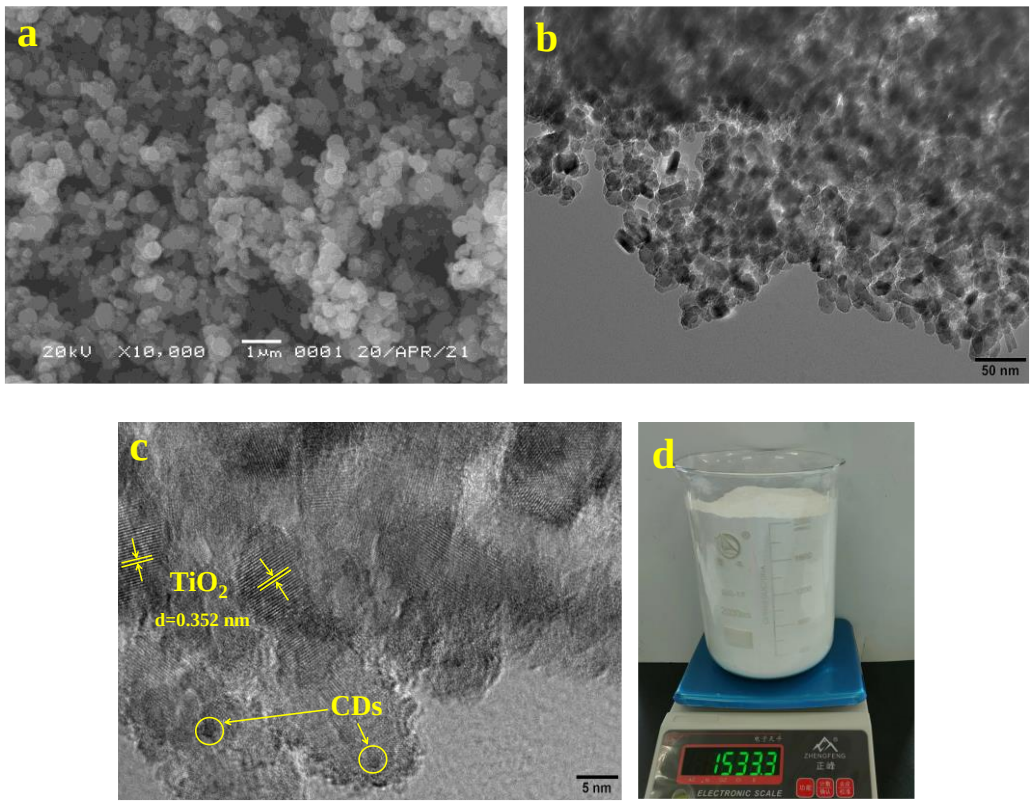

Fig. S2 SEM (a), HRTEM (b,c) and optical (d) images of kCT2.

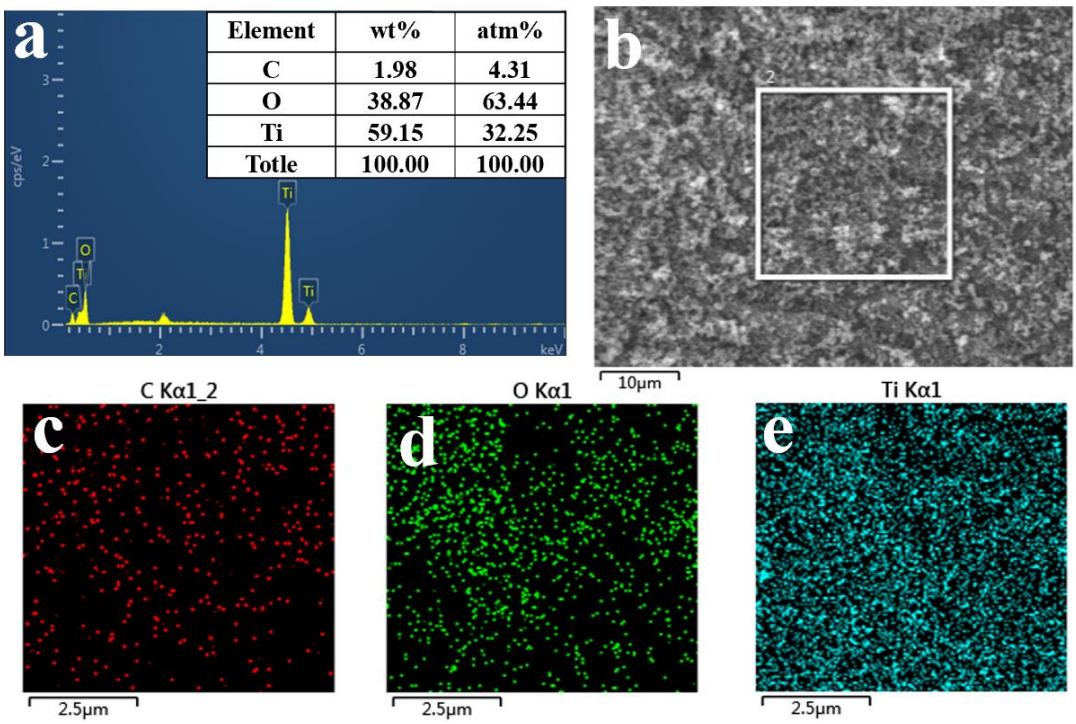

Fig. S3 EDS curve (a), SEM image (b) of kCT2, and the corresponding element mapping of C (c), O (d) and Ti (e) elements.

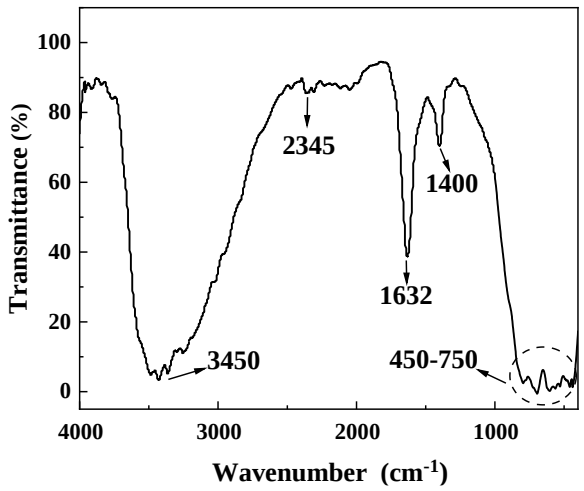

Fig. S4 FT-IR spectrum of kCT2.

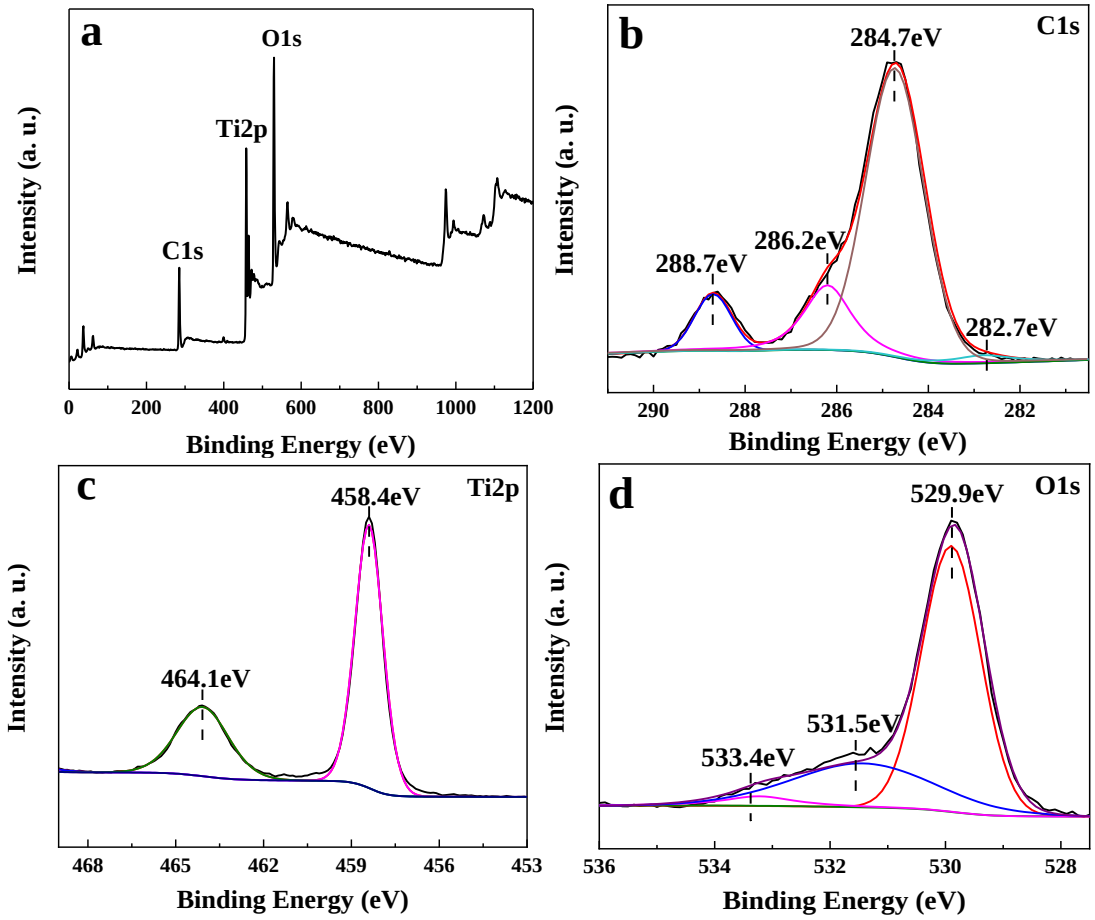

Fig. S5 XPS survey spectra (a), and the corresponding high-resolution XPS spectra of C 1s (b), Ti 2p (c) and O 1s (d) of kCT2.

Table S1 Comparison of photocatalytic degradation of MO over various non-metallic coupled TiO_2 photocatalysts.

Photocatalyst	Light source	Photocatalytic condition	Degradation activity	Degradation rate / ($mmol \cdot g^{-1} \cdot h^{-1}$)	Ref.
CDs/TiO_2 NPs (CT2 and kCT2)	300 W Xenon arc lamp ($\lambda > 420$ nm)	Photocatalyst: 30 mg MO solution: 30 mL, 10 $mg \cdot L^{-1}$	88.8% (120 min, CT2) 88.6% (120 min, kCT2)	0.0136 (CT2) 0.0135 (kCT2)	This study
C-TiO_2/g-C_3N_4 nanocomposite	300 W Xenon lamp ($\lambda > 400$ nm)	Photocatalyst: 50 mg MO solution: 50 mL, 20 $mg \cdot L^{-1}$	98.6% (60 min)	0.0602	1
Nanohybrids TiO_2/CNTs materials	150 W Xenon lamp ($\lambda > 420$ nm)	Photocatalyst: 25 mg MO solution: 50 mL, 10 $mg \cdot L^{-1}$	33% (240 min)	0.00504	2
GO/TiO_2 composites	Sunlight or 48 W UV lamp (λ = 240 nm)	Photocatalyst: 100 mg MO solution: 100 mL, 20 $mg \cdot L^{-1}$	40% (Sunlight for 240 min) 85.73% (UV light for 240 min)	0.00611 (Sunlight) 0.0131 (UV light)	3
Graphite/C-doped TiO_2 composite	500 W Xenon lamp ($\lambda < 420$ nm)	Photocatalyst: 50 mg MO solution: 30 mL, 10 $mg \cdot L^{-1}$	77.5% (120 min)	0.00710	4
g-C_3N_4 coupled with high specific area TiO_2 composite	300 W Xenon lamp	Photocatalyst: 100 mg MO solution: 40 mL, 1×10^{-4} mol/L	92.44% (100 min)	0.0222	5
C, N, F-tridoped TiO_2 nanotubes	300 W mercury lamp or 500 W Xenon lamp	Photocatalyst: 50 mg MO solution: 60 mL, 20 $mg \cdot L^{-1}$	completely degraded (UV light for 50 min or simulated sunlight for 300 min)	0.0880 (UV light) 0.0147 (Simulated sunlight)	6
N-doped mesoporous black TiO_2 photocatalyst	350 W Xenon lamp ($\lambda > 420$ nm)	Photocatalyst: 25 mg MO solution: 30 mL, 10 $mg \cdot L^{-1}$	93.27% (150 min)	0.0137	7
Nitrogen-doped TiO_2 nanoparticles sensitized by hematoporphyrin	150 W metal halide lamp	Photocatalyst: 300 mg MO solution: 300 mL, 5.0 $mg \cdot L^{-1}$	88.5% (180 min)	0.00451	8

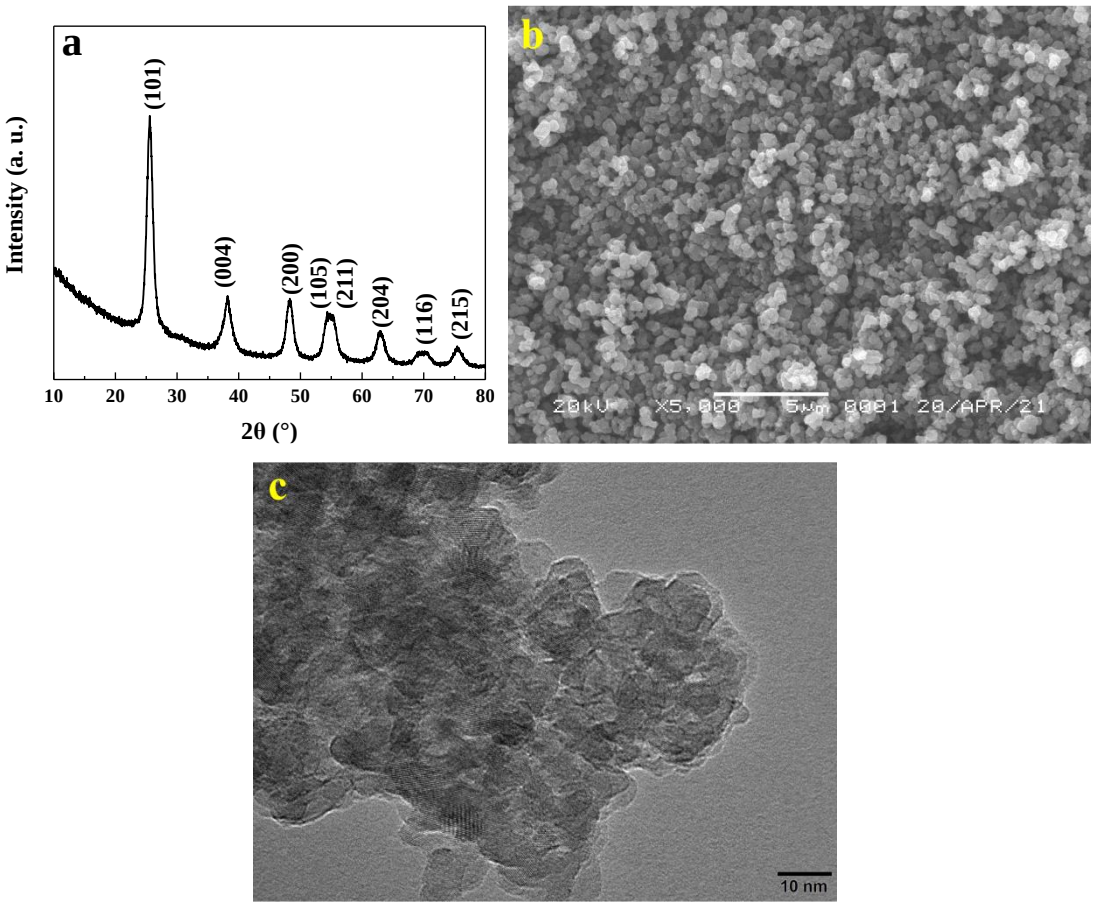

Fig. S6 XRD pattern (a), SEM image (b) and HRTEM image of kCT2 after 5 cycles (c).

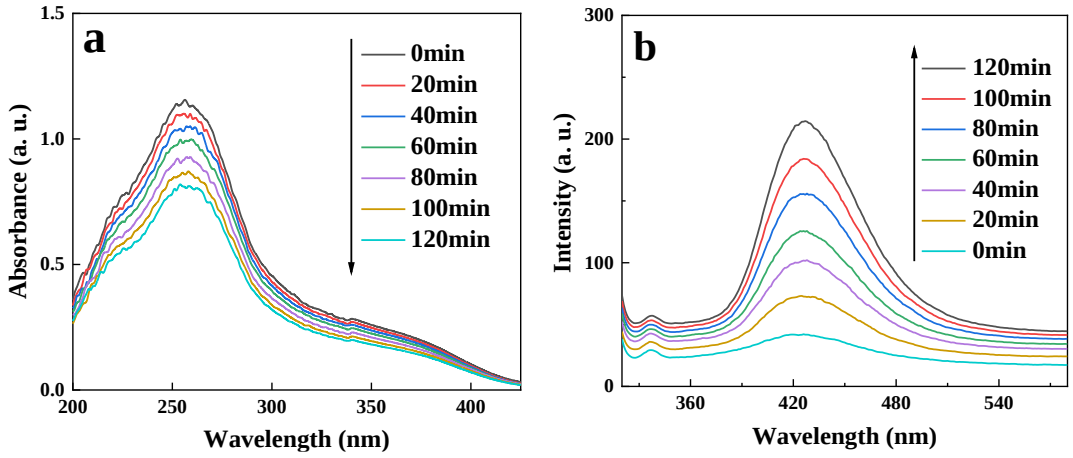

Fig. S7 UV-vis absorption spectra of NBT (a) and PL spectra of 2-TAOH in the presence of kCT2 (b).

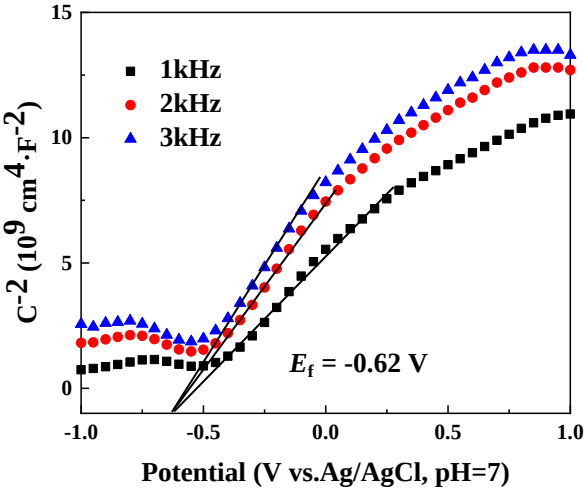

Fig. S8 M-S plots of TiO_2 NPs.

Reference

1 Z. Lu, L. Zeng, W. Song, Z. Qin, D. Zeng and C. Xie, *Appl. Catal., B*, 2017, **202**, 489-499.

2 K. C. Nguyen, M. P. Ngoc and M. V. Nguyen, *Mater. Lett.*, 2016, **165**, 247-251.

3 C. Lin, Y. Gao, J. Zhang, D. Xue, H. Fang, J. Tian, C. Zhou, C. Zhang, Y. Li and H. Li, *J. Mater. Res.*, 2020, **35**, 1307-1315.

4 J. Jia, D. Li, J. Wan and X. Yu, *J. Ind. Eng. Chem.*, 2016, **33**, 162-169.

5 M.-Y. Song, D.-W. Sun, R.-Q. Guan, J.-X. Li, H.-J. Zhai, L.-J. Wang, M.-Y. Sun, J.-W. Kang, J.-K. Zhang, Z. Zhao and X.-H. Li, *Chinese J. Chem. Phys.*, 2021, **34**, 210-216.

6 X. Wang, L.-L. Wang, D. Guo, L.-L. Ma, B.-L. Zhu, P. Wang, G.-C. Wang, S.-M. Zhang and W.-P. Huang, *Catal. Today*, 2019, **327**, 182-189.

7 H. Zhang, Y. Zhang, J. Yin, Z. Li, Q. Zhu and Z. Xing, *Chem. Phys.*, 2018, **513**, 86-93.

8 J. Saien and Z. Mesgari, *J. Mol. Catal., A*, 2016, **414**, 108-115.