Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Electronic Supplementary Information

Controlled synthesis of thorny anatase TiO_2 tubes for construction of Ag-AgBr/TiO_2 composites as highly efficient simulated solar-light photocatalyst

Guohui Tian[a], Yajie Chen[a], Hong-Liang Bao[b], Xiangying Meng[a], Kai Pan[a], Wei Zhou[a], Chungui Tian[a], Jian-Qiang Wang*[b], Honggang Fu*[a]

[a] Key Laboratory of Functional Inorganic Material Chemistry, Ministry of Education of the People's Republic of China, Heilongjiang University, Harbin 150080 P. R. China

[b] Shanghai Synchrotron Radiation Facility (SSRF), Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai, P. R. China

*Corresponding author: E-mail: fuhg@vip.sina.com, wangjianqiang@sinap.ac.cn; Tel.: +86 451 8660 4330, Fax: +86 451 8667 3647

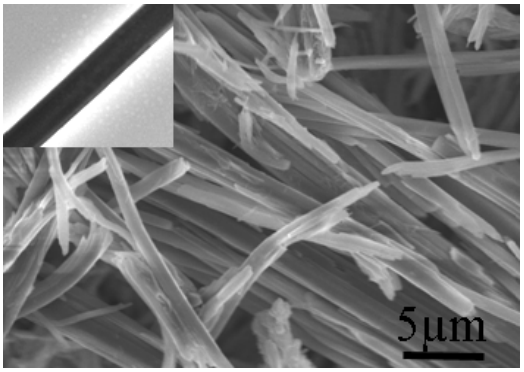

Fig. S1. SEM and TEM (inset) images of the rod-like $TiOSO_4 \cdot 2H_2O$ starting material.

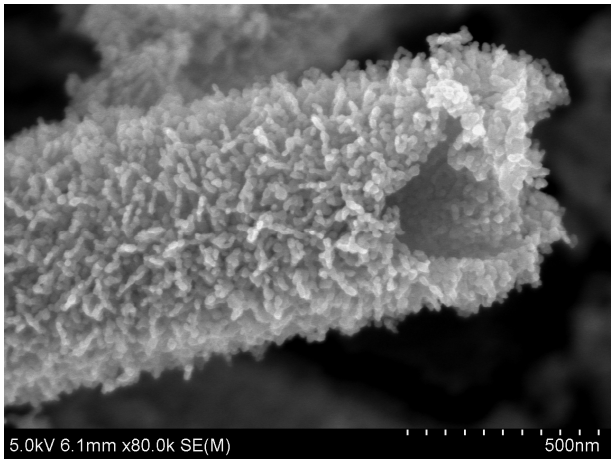

Fig. S2. High magnification SEM of the as-obtained thorny TiO_2 tube obtained from the calcined precursors (24 h solvothermal reaction).

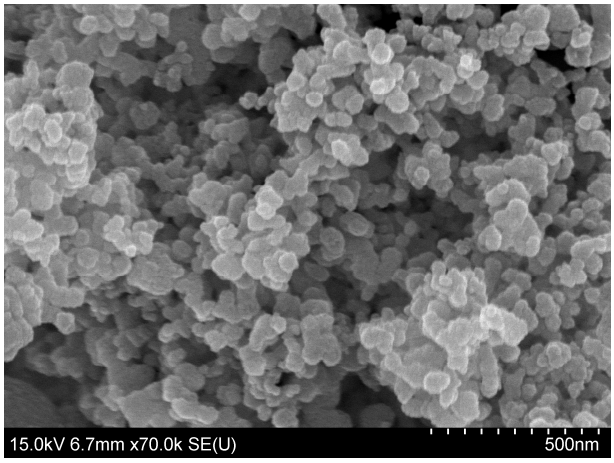

Fig. S3. SEM image of the prepared titanium glycerolate precursor using crushed $TiOSO_4 \cdot 2H_2O$ starting material.

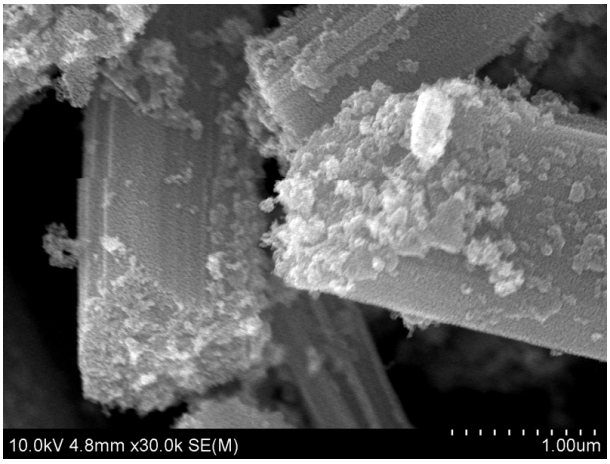

Fig. S4. SEM image of the precursor prepared without using glycerol.

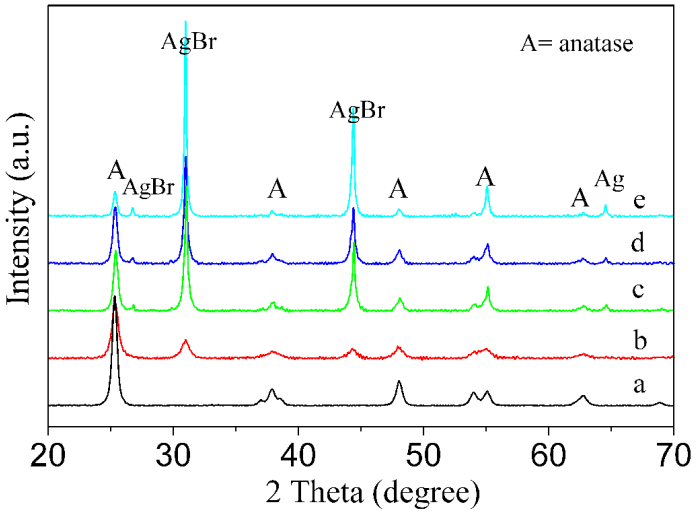

Fig. S5. XRD patterns of the different samples, a) thorny TiO_2 tube, b) 5%Ag-AgBr/TiO_2, c) 10%Ag-AgBr/TiO_2, d) 15%Ag-AgBr/TiO_2 and e) 20%Ag-AgBr/TiO_2.

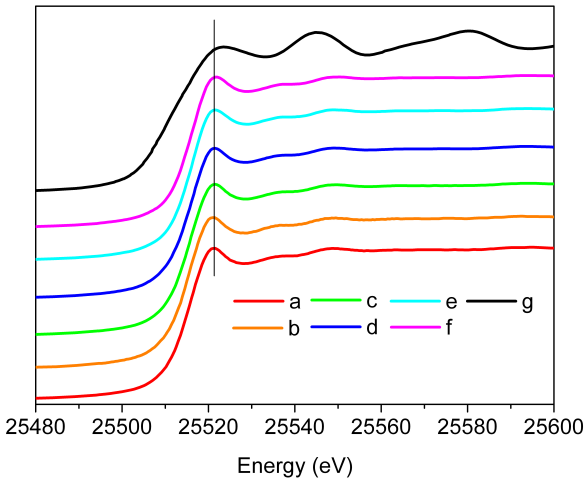

Fig. S6. Comparison of the Ag *K* - edge XANES spectra of the different samples. a) AgBr, b) 5% Ag-AgBr/TiO_2, c) 10% Ag-AgBr/TiO_2, d) 15% Ag-AgBr/TiO_2, e) 20% Ag-AgBr/TiO_2, f) 10% Ag-AgBr/TiO_2 after photocatalytic reaction, g) Ag foil.

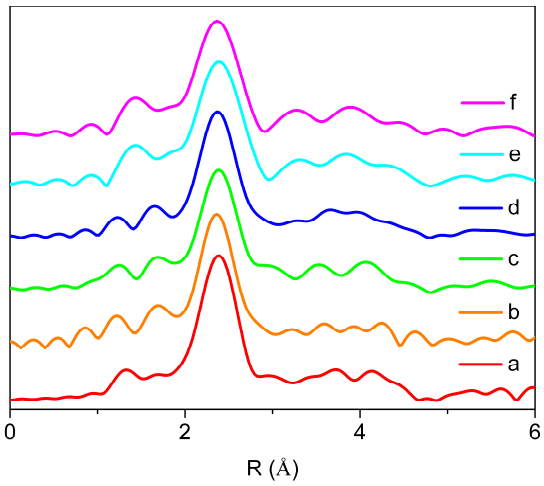

Fig. S7 Comparison of the Fourier-transformed EXAFS spectra for different samples: a) AgBr, b) 5% Ag-AgBr/TiO_2, c) 10% Ag-AgBr/TiO_2, d) 15% Ag-AgBr/TiO_2, e) 20%Ag-AgBr/TiO_2, f) 10% Ag-AgBr/TiO_2 after photocatalytic reaction.

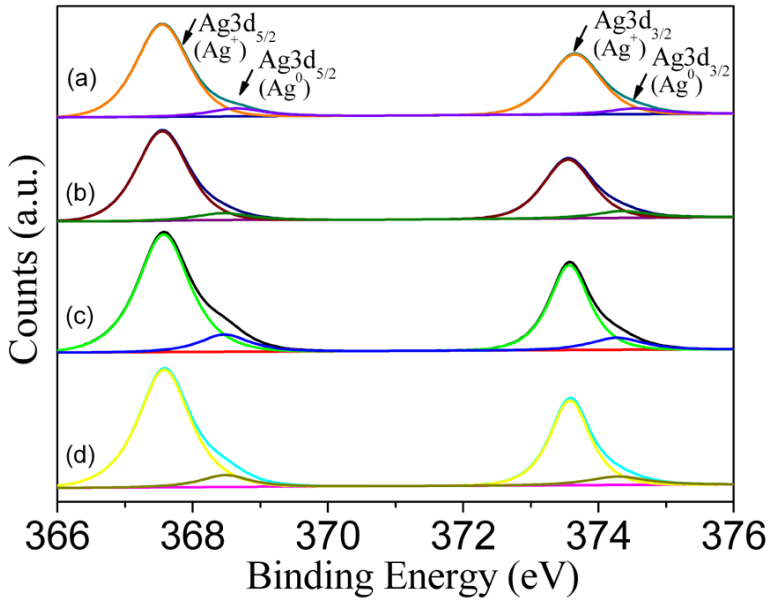

Fig. S8. XPS spectra of Ag 3d of the different samples, (a) 5%Ag-AgBr/TiO_2, (b) 10%Ag-AgBr/TiO_2, (c) 15%Ag-AgBr/TiO_2, (d) 20%Ag-AgBr/TiO_2.

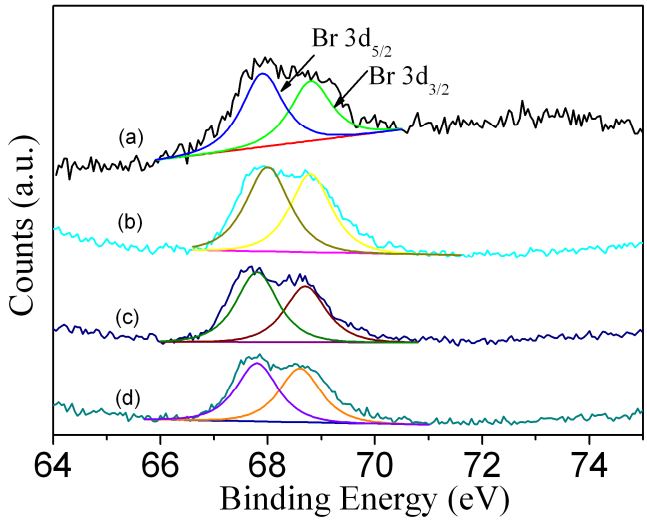

Fig. S9. XPS spectra of Br 3d of the different samples, (a) 5%Ag-AgBr/TiO_2, (b) 10%Ag-AgBr/TiO_2, (c) 15%Ag-AgBr/TiO_2, (d) 20%Ag-AgBr/TiO_2.

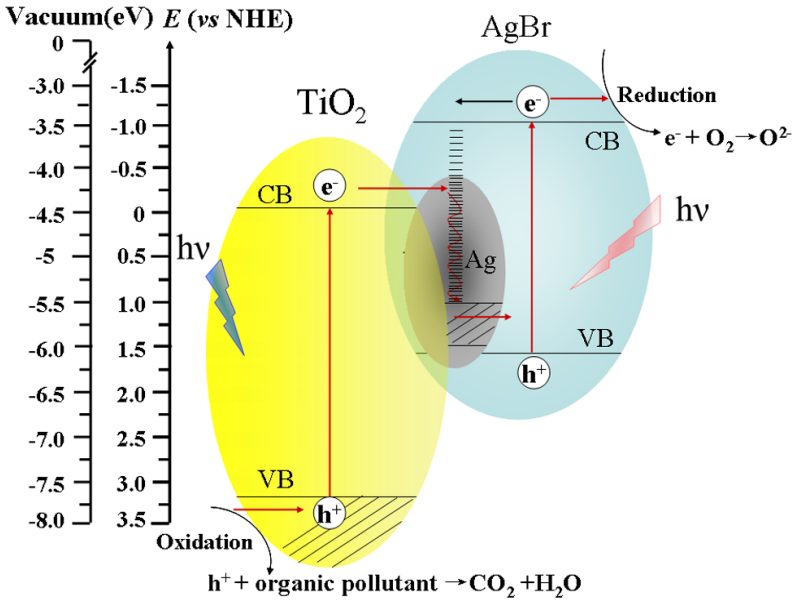

Fig. S10. Schematic diagram for the charge separation in Ag-AgBr/TiO_2 composites system under simulated solar light irradiation.

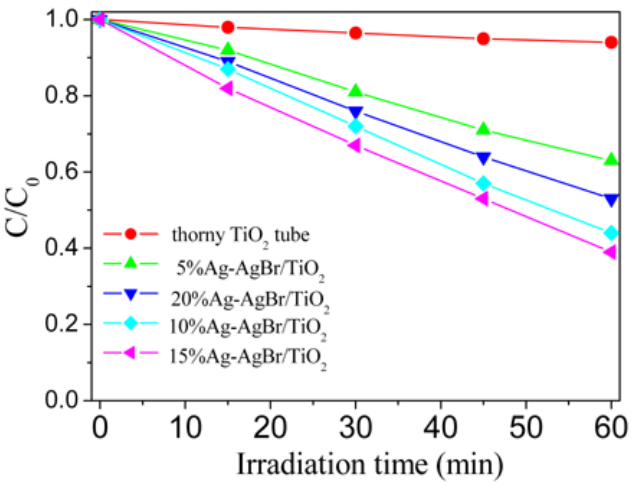

Fig. S11. Photocatalytic degradation of phenol as a function of irradiation time in the presence of different photocatalysts under visible light irradiation.

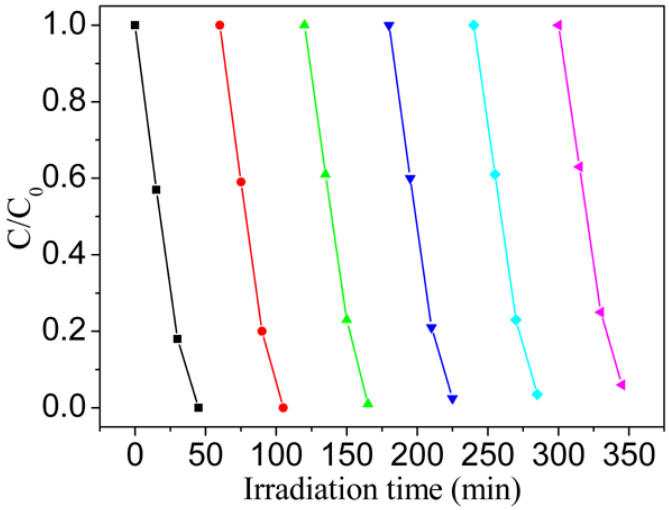

Fig. S12. Cycling runs in the photodegradation of phenol in the presence of 10%Ag-AgBr/TiO_2 composite under simulated solar light irradiation; addition of phenol.

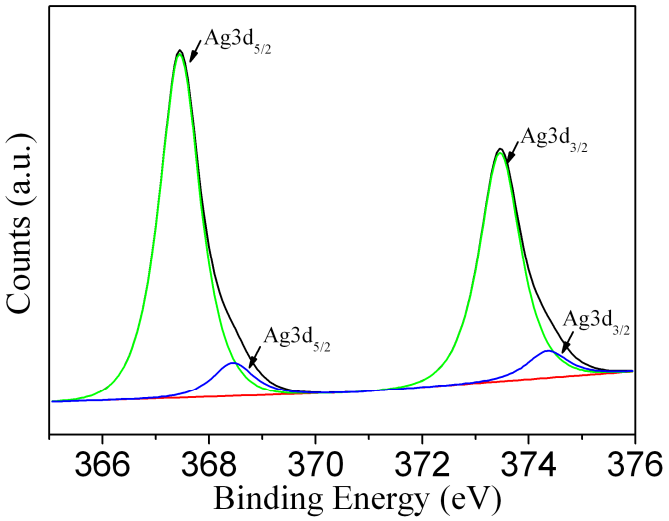

Fig. S13. XPS spectrum of Ag 3d of the 10%Ag-AgBr/TiO_2 after photocatalytic degradation of phenol under simulated solar light irradiation.

Table S1. Fit parameters of Ag EXAFS spectra of the different samples. a) AgBr, b) 5%Ag-AgBr/TiO_2, c) 10%Ag-AgBr/TiO_2, d) 15%Ag-AgBr/TiO_2, e) 10%Ag-AgBr/TiO_2 after photocatalytic reaction.

	Shell	N[a]	R[b]	σ^2 (10^{-3} Å^2) [c]	ΔE_0 (eV) [d]
a	Ag-Br	3.1±0.8	2.78±0.01	13.3±2.3	-3.6±1.5
b	Ag-Br	1.9±0.2	2.78±0.02	9.0±3.8	0.8±0.7
	Ag-Ag	0.1±0.1	2.87±0.01	7.0±1.5	4.9±1.3
c	Ag-Br	1.8±0.2	2.78±0.01	8.8±4.1	0.5±0.5
	Ag-Ag	0.3±0.1	2.87±0.01	3.6±1.6	6.6±3.5
d	Ag-Br	1.8±0.3	2.78±0.02	8.5±3.0	-1.0±0.3
	Ag-Ag	0.2±0.1	2.87±0.01	4.9±1.2	5.5±0.7
e	Ag-Br	1.5±0.2	2.78±0.02	13.1±2.7	1.4±0.7
	Ag-Ag	0.6±0.1	2.90±0.01	12.4±1.6	6.1±1.3

[a] Coordination number; [b] Distance between absorber and backscatter atoms; [c] Debye–Waller factor; [d] Inner potential correction.

Table S2. The surface element kind and content in the different photocatalysts

sample	surface element	Content (mol%)
5% Ag-AgBr/TiO_2	Ag^0	1.12
	Ag^+	3.71
	Br^-	3.42
10%Ag-AgBr/TiO_2	Ag^0	2.11
	Ag^+	7.62
	Br^-	7.32
15%Ag-AgBr/TiO_2	Ag^0	3.11
	Ag^+	11.52
	Br^-	11.31
20%Ag-AgBr/TiO_2	Ag^0	4.11
	Ag^+	15.52
	Br^-	15.16