Electronic Supplementary Information

3D hierarchical flower-like TiO_2 nanostructure: morphology control and its photocatalytic property

Guohui Tian,[a,b] Yajie Chen,[b] Wei Zhou,[b] Kai Pan,[b] Chungui Tian,[b] Xu-ri Huang*[a] and Honggang Fu*[b]

[a] *State Key Laboratory of Theoretical and Computation Chemistry, Jilin University, Changchun 130023, People's Republic of China, E-mail: huangxr@mail.jlu.edu.cn*

[b] *Key Laboratory of Functional Inorganic Material Chemistry, Ministry of Education of the People's Republic of China, Heilongjiang University, Harbin 150080 P. R. China, fuhg@vip.sina.com*

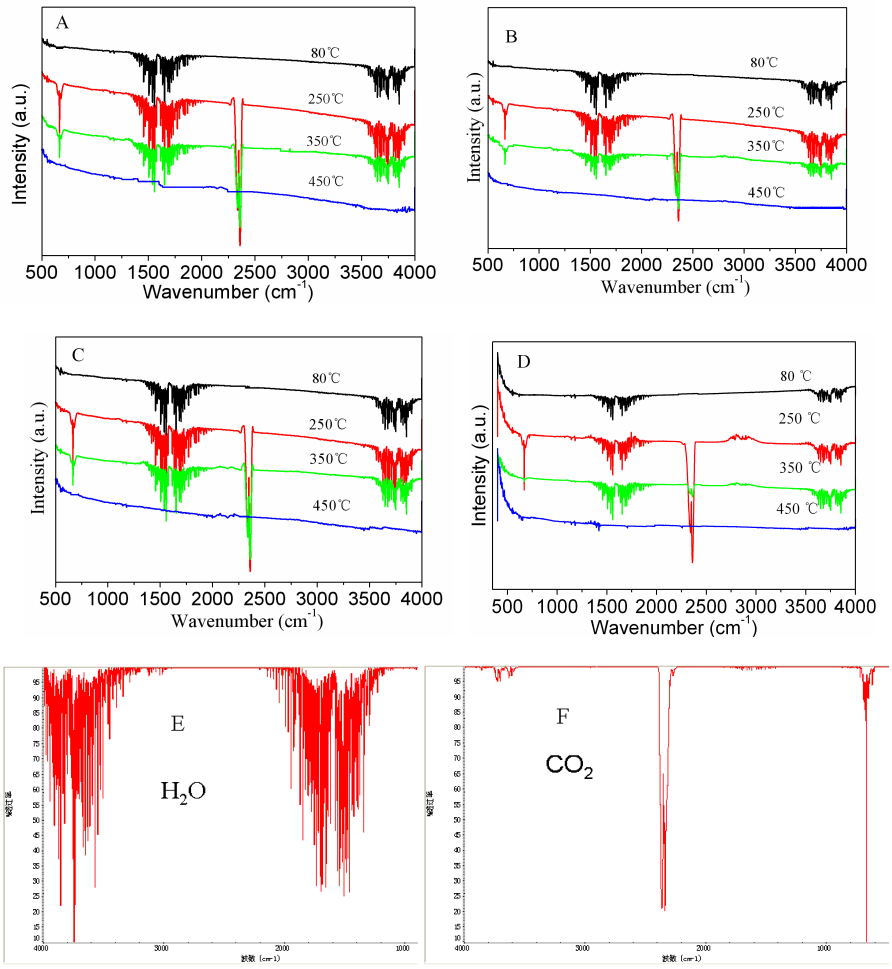

Fig. S1 Evolution with the temperature of the FTIR spectra of the gases evolved in the thermal pyrolysis of precursor prepared from different solvothermal reaction time under air: (A) 1 h, (B) 6 h, (C) 12 h, (D) 24 h. The standard FTIR spectra of (E) H_2O and (F) CO_2.

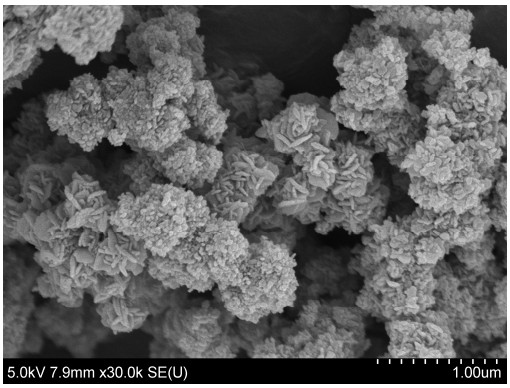

Fig. S2 SEM image of the precursor prepared from solvothermal reaction at 110 °C for 24 h.

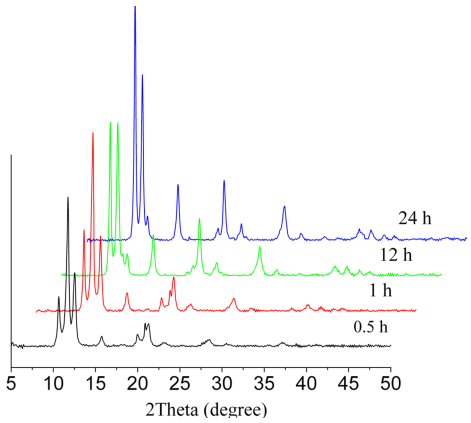

Fig. S3 XRD patterns of the prepared precursors obtained from different solvothermal reaction time (0.5, 1, 12 and 24 h) at 180 ℃ in the absence of ethanol.

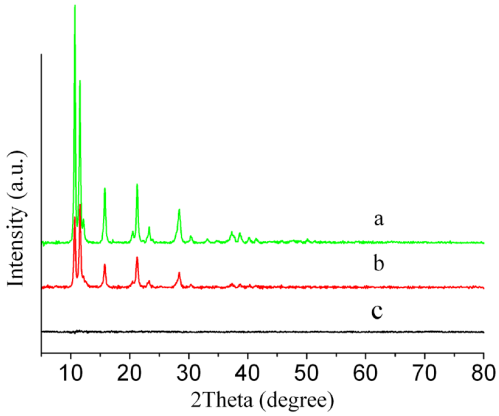

Fig. S4 XRD patterns of (a) product from the solvothermal reaction of tetrabutyl titanate with glycerol; (b) product from the solvothermal reaction of glycerol with titanium oxyhydrate; (c) product from the solvothermal reaction of tetrabutyl titanate with ethanol.

In order to understand the dissolution-recrystallization growth mechanism in-depth,

and prove that glycerol can coordinate with Ti^{4+} by replacing the hydroxyls in titanium oxyhydrate, some control experiments are carried out. One experiment is that, tetrabutyl titanate and glycerol were mixed together, and the resulting clear solution was transferred into a 50 mL teflon-lined stainless steel autoclave, which was heated to 180 °C and maintained for 24 h. The XRD pattern of the obtained product was listed in pattern a in Fig. S4. The XRD pattern shows one sharp peak at ca. 10° with several weak ones at higher 2θ degree, indicating the formation of titanium glycerolate (TiGly) phase. The second experiment is that, tetrabutyl titanate and ethanol were mixed together, and the resulting clear solution was transferred into a 50 mL teflon-lined stainless steel autoclave, which was heated to 180 °C and maintained for 0.5 h. The XRD pattern of the obtained product was listed in pattern c in Fig. S4. No obvious peak was found, indicating amorphous status materials (primary titanium oxyhydrate). Then the obtained amorphous status materials (primary titanium oxyhydrate) was further mixed with glycerol and transferred into a 50 mL teflon-lined stainless steel autoclave, which was heated to 180 °C and maintained for 24 h. The XRD pattern of the obtained product was listed in pattern b in Fig. S4, which is similar to pattern a in Fig. S4, indicating the formation of titanium glycerolate (TiGly) phase. The control experimental results showed that titanium oxyhydrate can react with glycerol and form titanium glycerolate (TiGly) phase and allow dissolution-renucleation, which is agreed with the previous reports that the metal hydroxide can react with glycerol to form the alkoxide. [1,2]

References

[1] C. Q. Wang, D. R. Chen and X. J. Jiao, *J. Phys. Chem. C*, 2009, **113**, 7714-7718.

[2] X. C. Jiang, Y. L. Wang, T. Herricks and Y. N. Xia, *J. Mater. Chem.*, 2004, **14**, 695-703.