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Electronic Supplementary Information

Preparation of annular TiO_2 nanoparticles constructed by high-energy surfaces and enhanced visible-light photocatalytic activity

Fanxia Kong,[a,b] Yuguo Xia,[a,b] Xiuling Jiao [a]*, Dairong Chen [a]

[a] *School of Chemistry & Chemical Engineering, National Engineering Research Center for Colloidal Materials, Shandong University, Jinan 250100, P.R. China.*

[b] *These authors contributed equally to this work.*

* *Corresponding author: Xiuling Jiao Email:jiaoxl@sdu.edu.cn*

Fig. S1 TEM images of final TiO_2-NCs with different amount of water. (a) 0 μL, (b)10 μL, (c) 20 μL, (d) 40 μL, (e) 50 μL and (f) 70 μL.

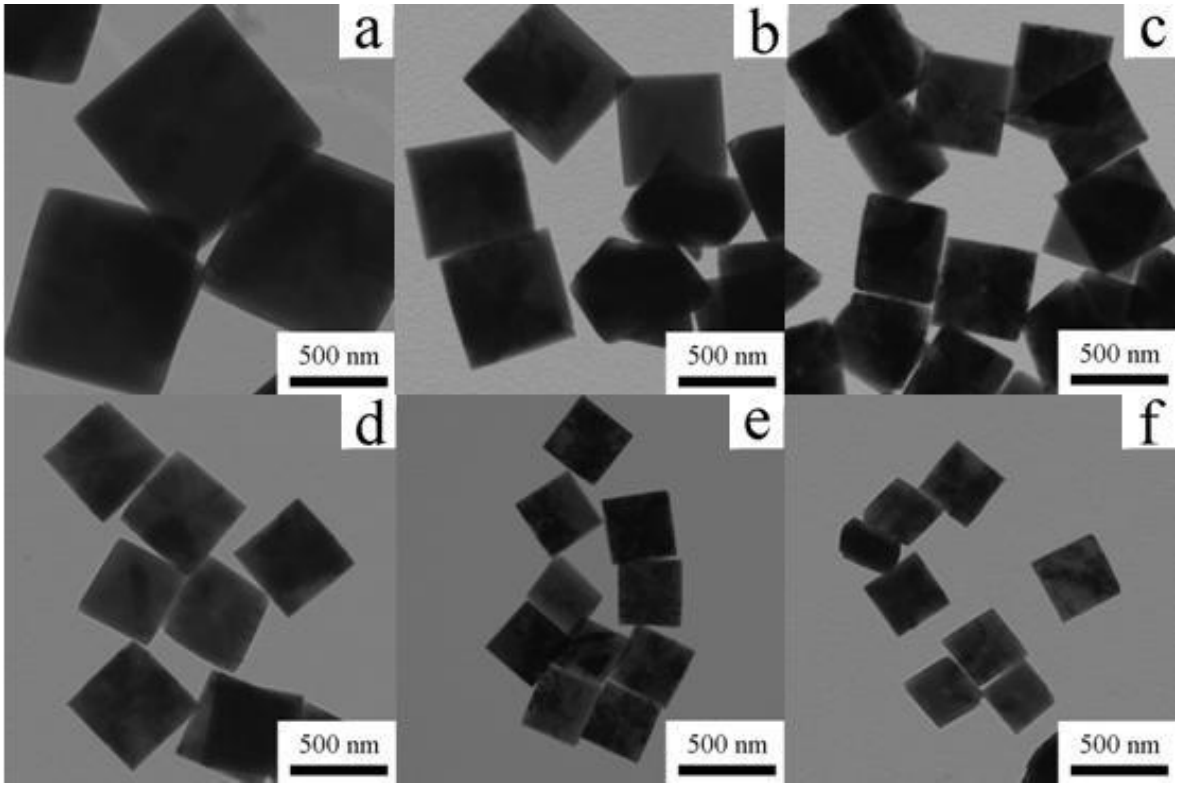

Fig. S2 XRD patterns of products in the time-dependent experiments.

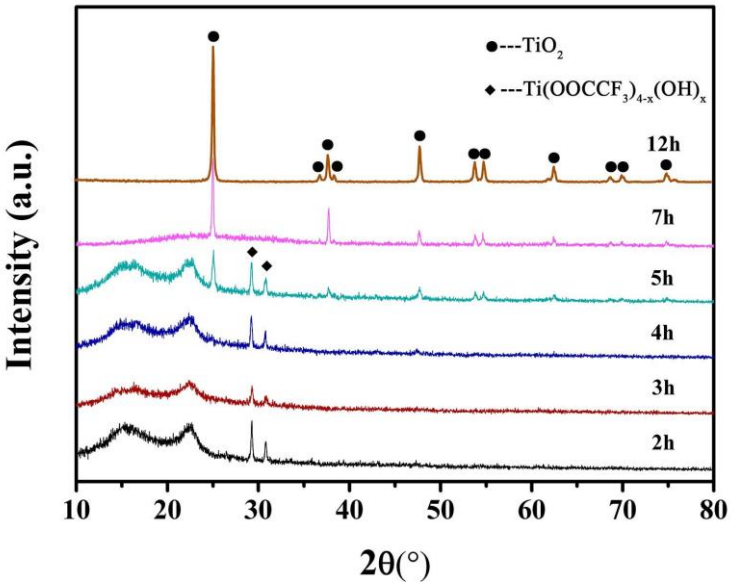

Fig. S3 Low magnification TEM image (a) and high magnification TEM image (b) of product at 5 h. Fig. S3b is the magnified image of the area labeled by dash line in Fig. S3a.

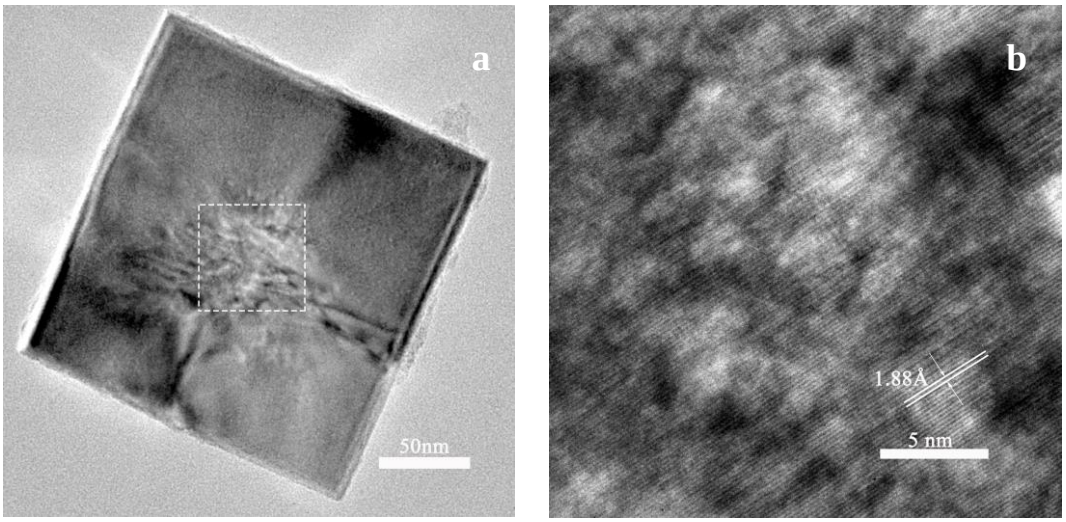

Fig. S4 UV-vis/diffuse reflectance spectra of the TiO_2-NCs and TiO_2-ASs comparing with Degussa P25. Inset shows an optical image of TiO_2-NCs and TiO_2-ASs dispersed in ethanol.

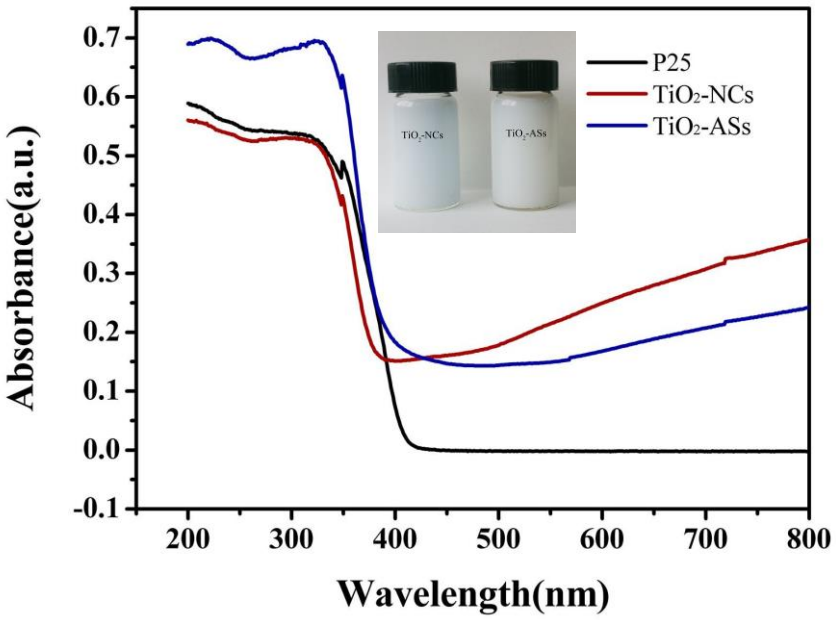

Fig.S5 Comparisons of original TiO_2-NCs (TiO_2-ASs) and corresponding samples reserved for 3 months, (a) XRD patterns and (b) UV-vis spectra.

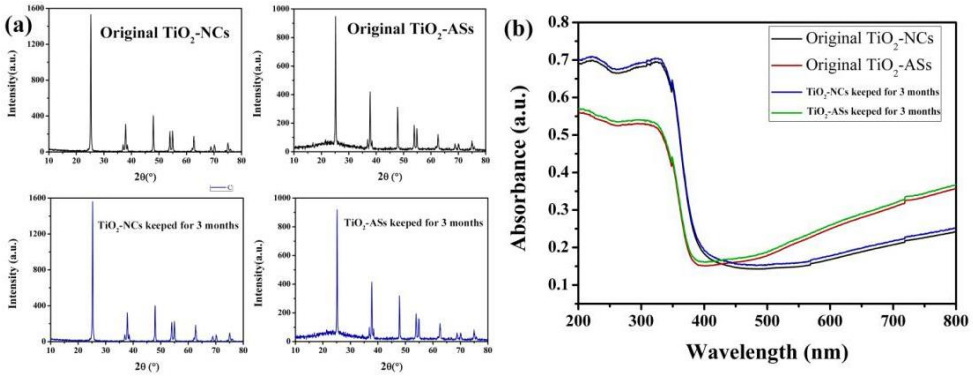

Fig. S6 Schematic diagram of RhB degraded into Rh-110.

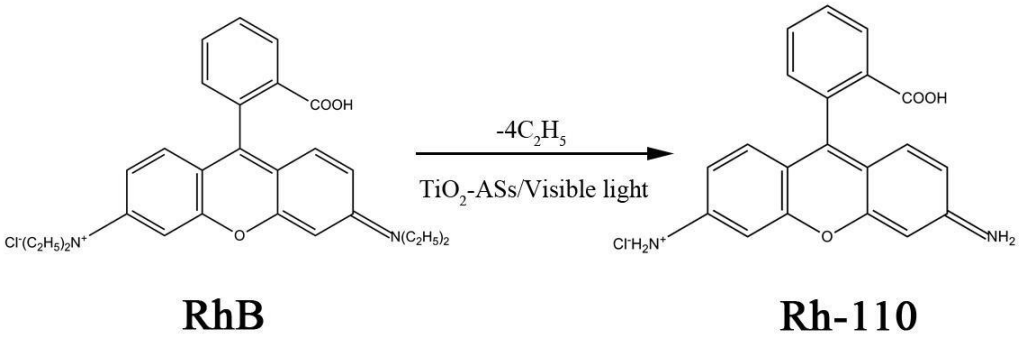

Table S1 Detailed parameters for geometries optimization of TiO_2 three crystal planes.

Planes	(100)	(001)	(110)
Number of atoms	72	72	72
Surface periodicity	$2\vec{b} \times 1\vec{c}$	$2\vec{a} \times 2\vec{b}$	$2u \times 1c$
K-point	2×1×1	2×2×1	1×1×1
Vacuum depth	15 Å	15 Å	15 Å

Table S2 Average crystalline size, specific surface area and the fluorine content for Degussa P25, TiO_2-NCs and TiO_2-ASs.

sample	**Degussa P25**	**TiO_2-NCs**	**TiO_2-ASs**
average crystalline size (nm)	25	380	230
S_{BET} (m^2/g)	55	7.2	16.7

Table S3 Proportion of elements or molecular in the surface of TiO_2-NCs and TiO_2-ASs calculated from XPS analysis.

	TiO_2-NCs	TiO_2-ASs
Ti^{4+} $2p_{3/2}$	63.0%	24.7%
Ti^{4+} $2p_{1/2}$	30.2%	13.6%
Ti^{3+} $2p_{3/2}$		3.7%
Ti^{3+} $2p_{1/2}$	6.8%	
Ti^{3+} $2p_{3/2}(TiF_3)$		42.3%
Ti^{3+} $2p_{1/2}(TiF_3)$		15.7%
$O^{2-}(O\text{-}Ti^{4+})$	87.5%	27.1%
-OH	7.3%	44.6%
H_2O	5.2%	15.7%
$O^{2-}(O\text{-}Ti^{3+})$		12.6%

Table S4 Amount of surface hydroxyls and surface water molecular calculated from O1s XPS spectra.

sample	amount of surface hydroxyls	amount of surface water	total
TiO_2-NCs	7.3%	5.2%	12.5%
TiO_2-ASs	44.6%	15.7%	60.3%