Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

The Effect of Aspect Ratios of Rutile TiO_2 Nanorods on Photocatalytic Overall Water Splitting Performance

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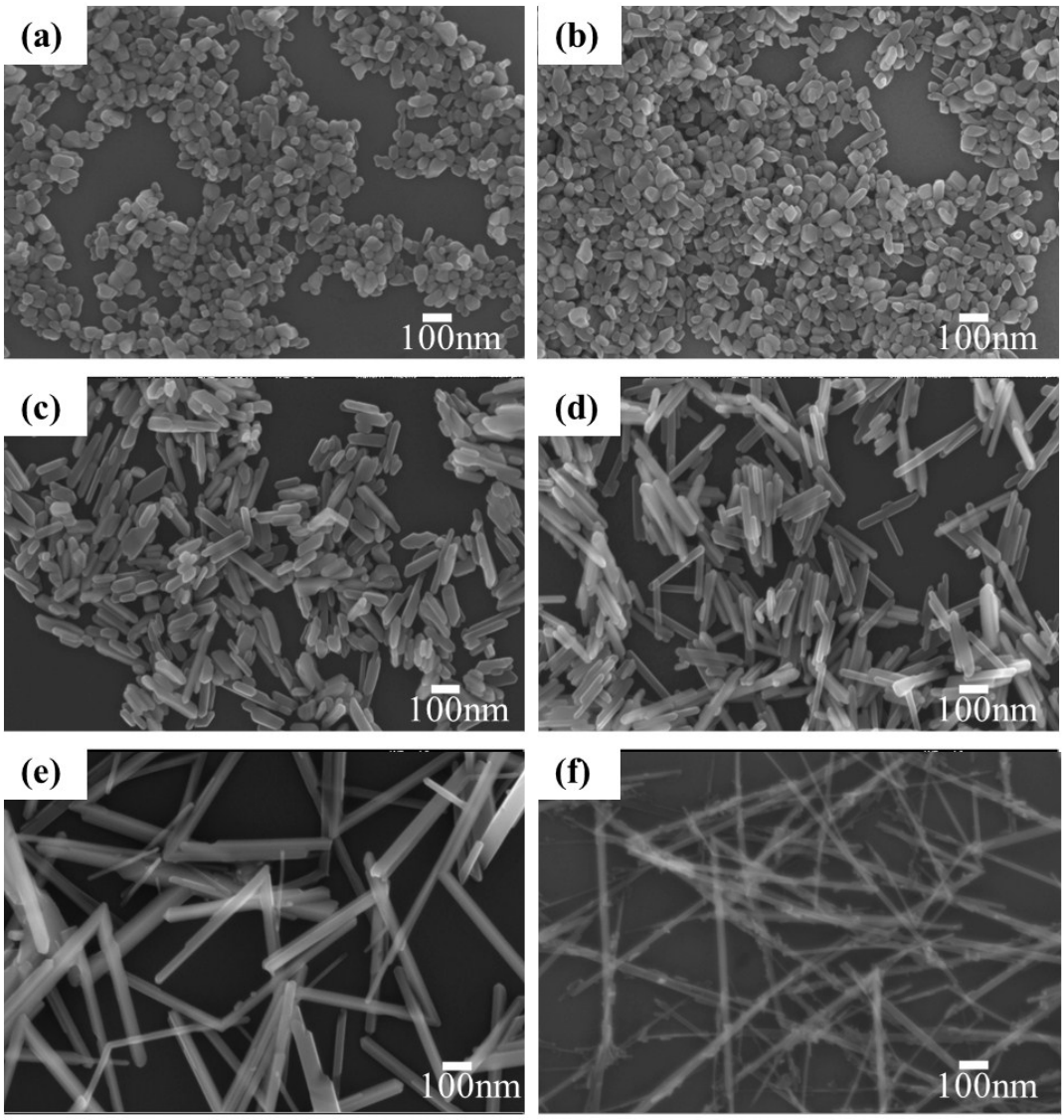

Fig. S1. FESEM images of rutile TiO_2 with *Small*, *Middle* and *Large* aspect ratio, respectively. (a) *Small* ($TiCl_4$-0.25-3), (b) *Small* ($TiCl_4$-0.25-3.5), (c) *Middle* (HCl-sol-1.5), (d) *Middle* (HCl-sol-8), (e) *Large* (NaCl-sol-2.5), (f) *Large* (NaCl-sol-6).

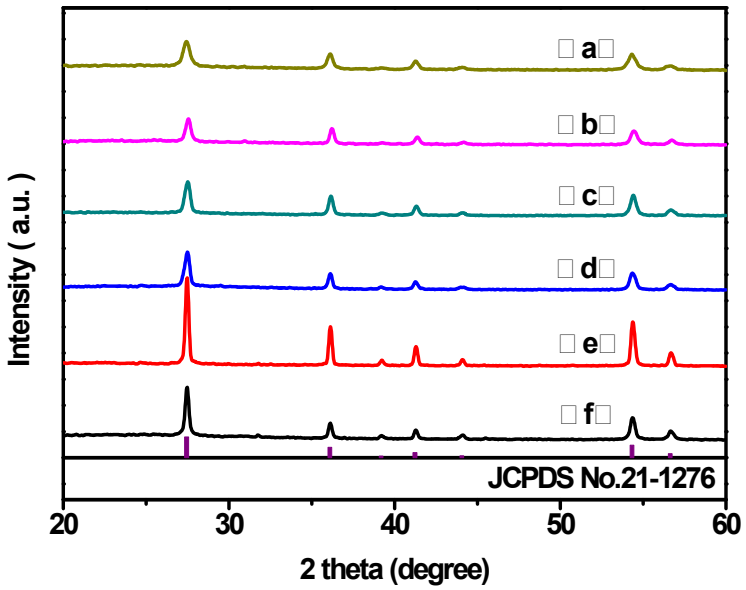

Fig. S2. XRD patterns of rutile TiO_2 with *Small*, *Middle* and *Large* aspect ratio, respectively. (a) *Small* ($TiCl_4$-0.25-3), (b) *Small* ($TiCl_4$-0.25-3.5), (c) *Middle* (HCl-sol-1.5), (d) *Middle* (HCl-sol-8), (e) *Large* (NaCl-sol-2.5), (f) *Large* (NaCl-sol-6).

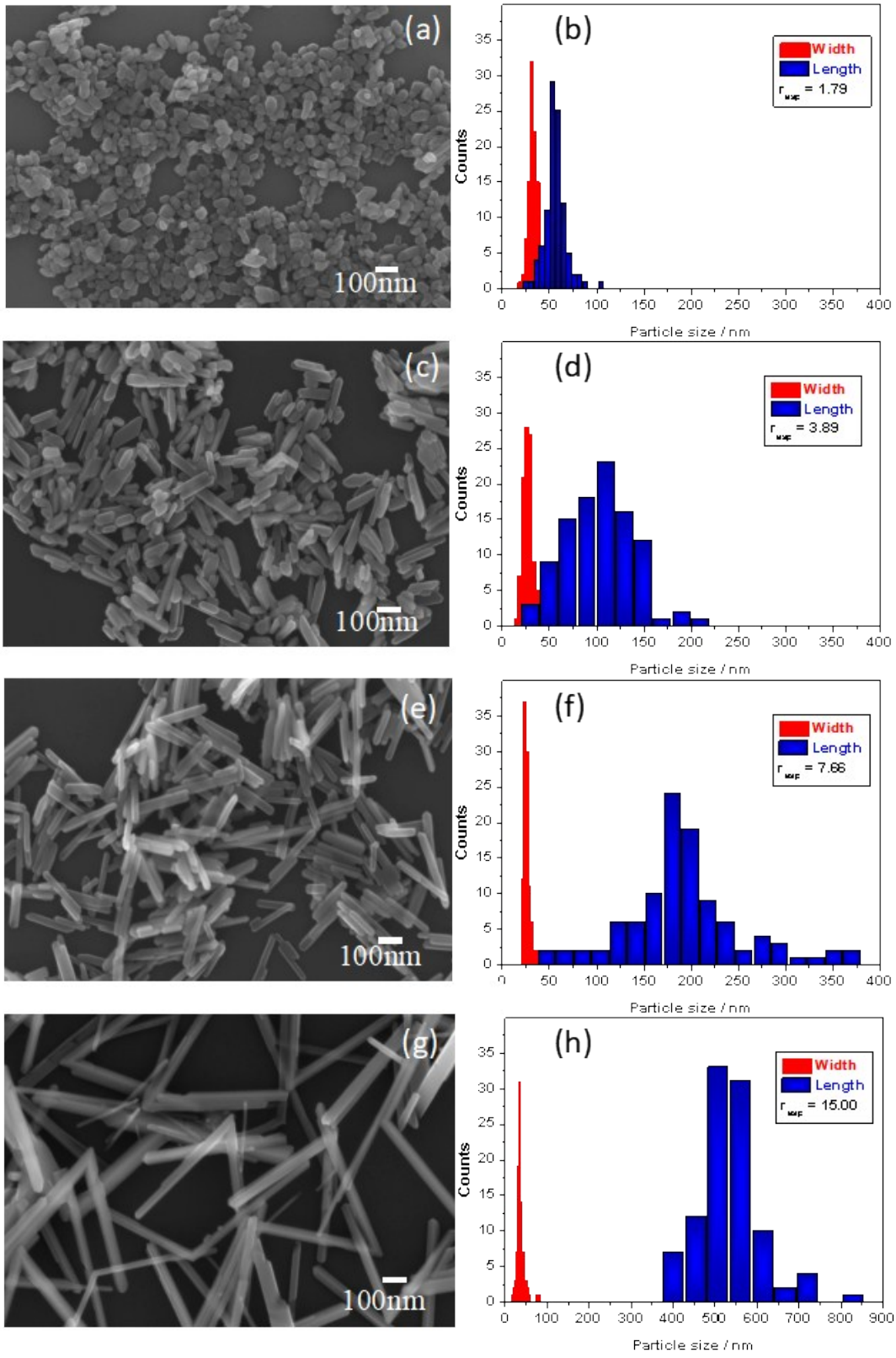

Fig. S3. (a), (c), (e) and (g)are FESEM images of rutile TiO_2 nanorods with *Small*,

Middle (3.89), *Middle* (7.66) and *Large* aspect ratio, respectively. (b), (d), (f) and(h) shows the width (red) and length (purple) distribution, and the samples correspond to (a), (c), (e) and (g), respectively.

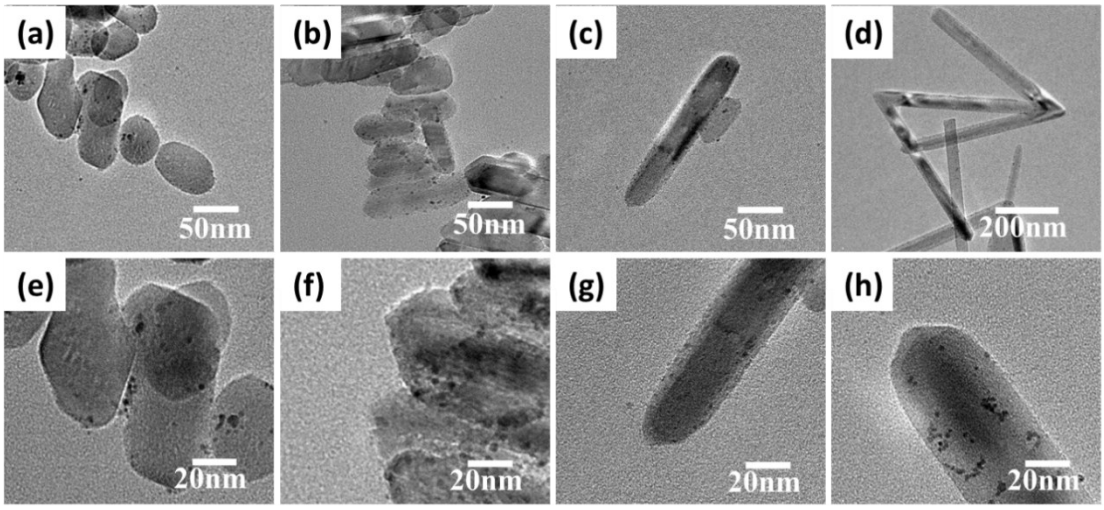

Fig. S4. TEM images of Pt nanoparticles photo-deposited on the surface of rutile TiO_2 nanorods with *Small* (r_{asp}=1.79 (a) (e)), *Middle* (r_{asp}=3.89 (b) (f)), *Middle* (r_{asp}=7.66 (c) (g)) and *Large* (r_{asp}=15.00 (d) (h)) aspect ratio.

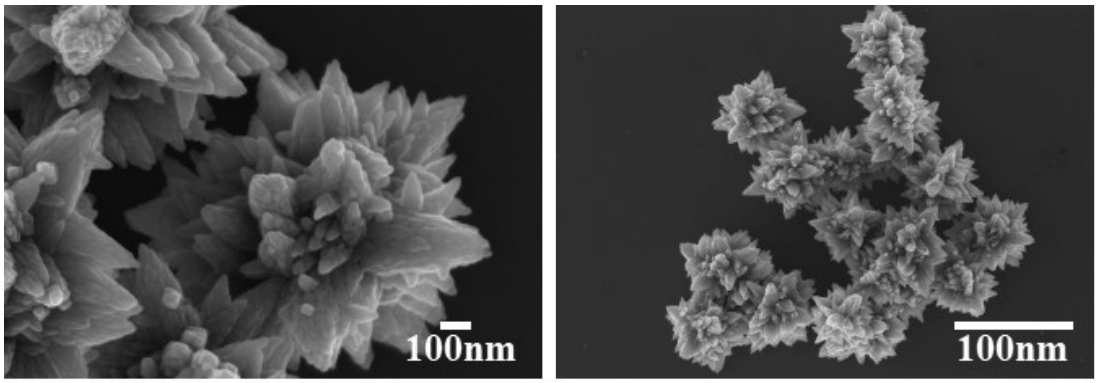

Fig. S5. FESEM images of rutile TiO_2 crystals grown from the HOOCCOOH solution.

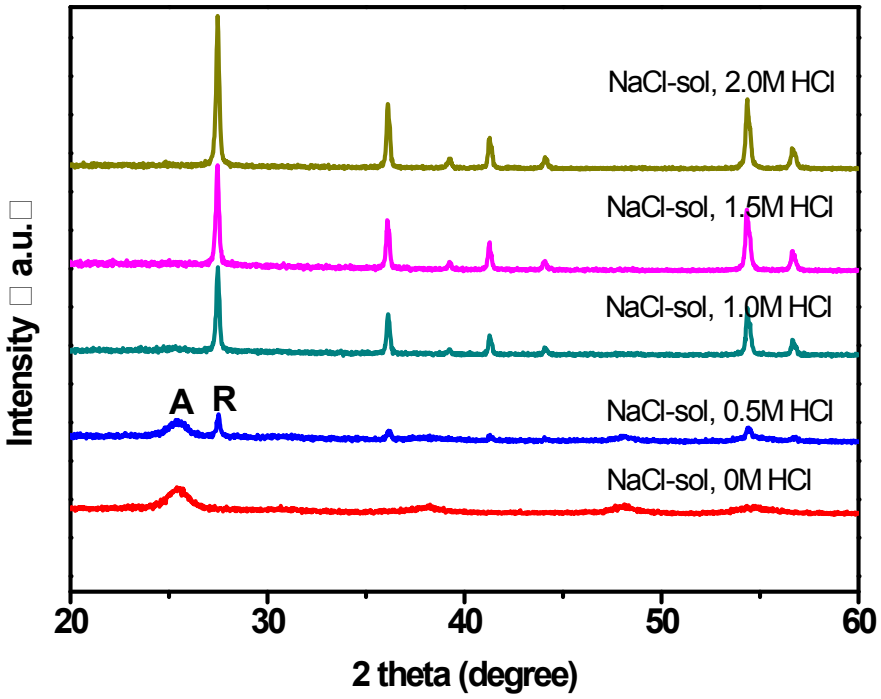

Fig. S6. XRD patterns of TiO_2 grown from anatase TiO_2 crystal seeds at different concentration of HCl. R-Rutile, A-Anatase.

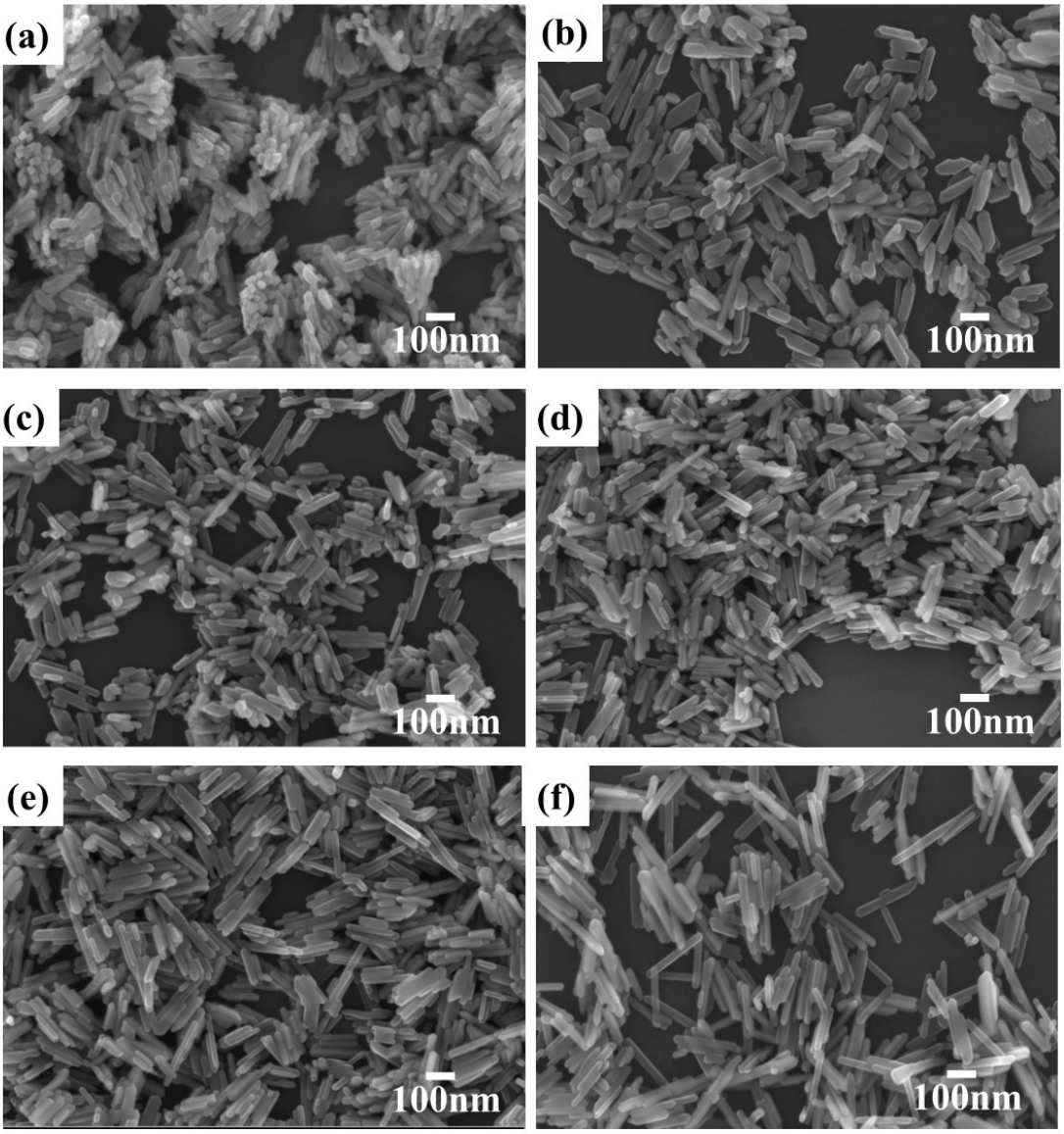

Fig. S7. FESEM images of rutile TiO_2 nanorods grown from rutile TiO_2 crystal seeds at different concentration of HCl; 0.9M(a), 1.5M(b), 2.0M(c), 4.0M(d), 6.0M(e) and 8.0M(f). Reaction condition: HCl-sol, 180℃, 8h.

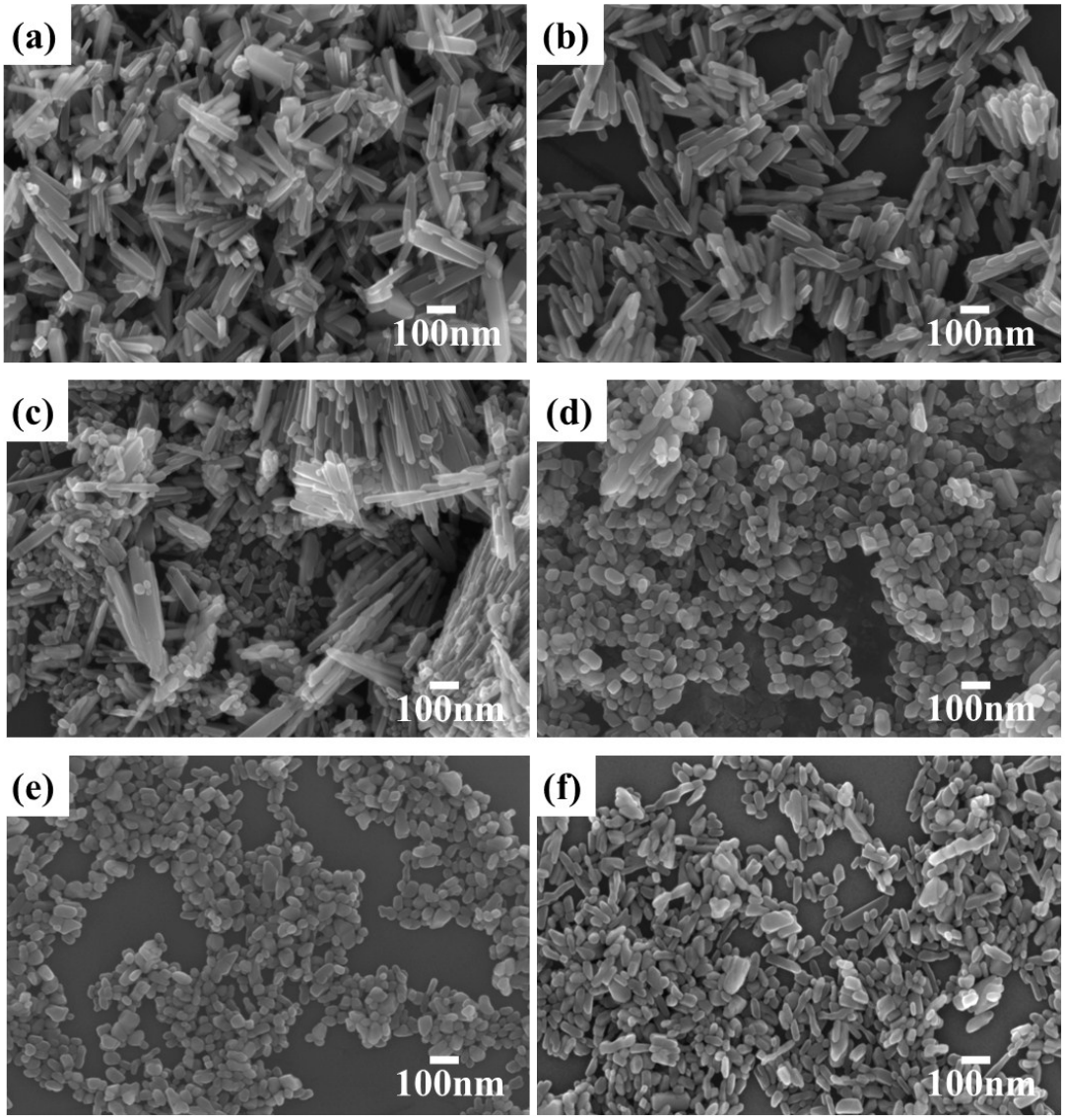

Fig. S8. FESEM images of rutile TiO_2 nanorods grown from titanium tetrachloride ($TiCl_4$) in a strong acidic aqueous solution by one-step synthesis. $TiCl_4$-0.5-0(a), TiCl4-1.0-0(b), $TiCl_4$-1.0-1.0(c), $TiCl_4$-0.25-2.5(d), $TiCl_4$-0.25-3.0(e) and $TiCl_4$-0.25-3.5(f). Reaction condition: $TiCl_4$, 180℃, 12h.

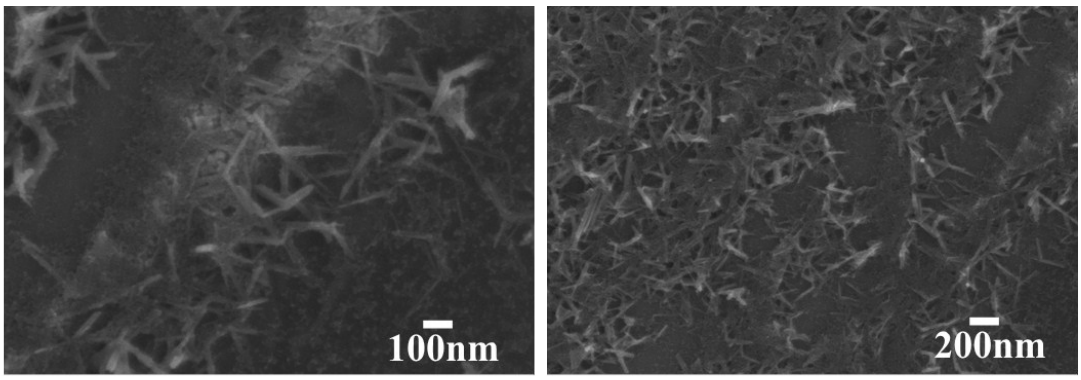

Fig. S9. FESEM images of TiO_2 grown from anatase TiO_2 crystal seeds at 140℃ for 8h. Reaction condition: NaCl-sol, 3M HCl, 8h.

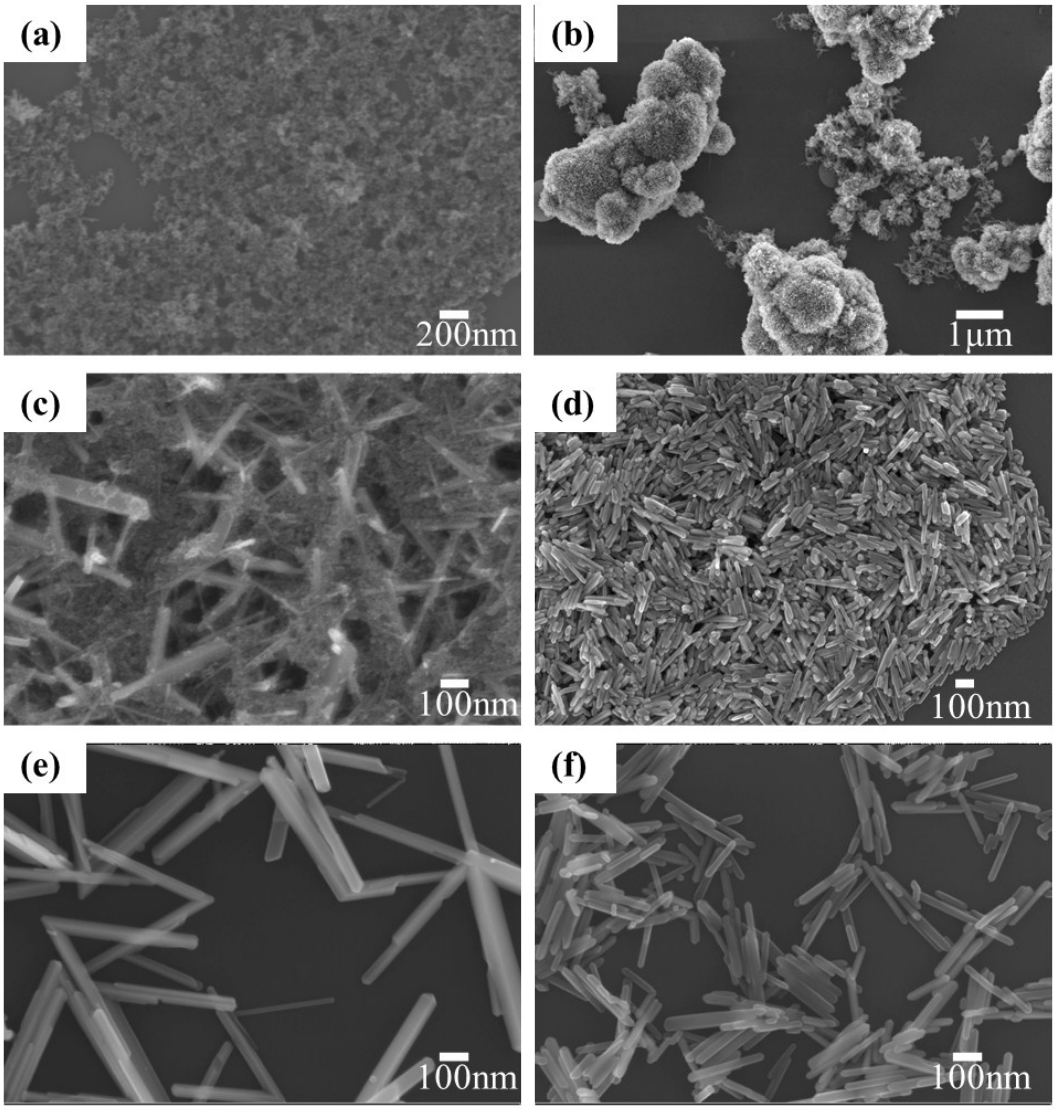

Fig. S10. Growth processes of rutile TiO_2 nanorods with *Middle/Large* aspect ratio. (a), (c) and (e) are FESEM images of rutile TiO_2 nanorods grown from rutile TiO_2 crystal seeds at 180℃ for 0.5, 4 and 8 hours, respectively. (b), (d) and (f) are FESEM images of rutile TiO_2 nanorods grown from anatase TiO_2 crystal seeds at 180℃ for 0.5, 4 and 8 hours, respectively.

Table S1. The photocatalytic pure water splitting activity of different rutile TiO_2.

Semiconductor	Cocatalyst	Light source	Activity/μmol•g^{-1}•h^{-1}		Refs
			H_2	O_2	
Rutile TiO_2 powder	0.1wt%Pt	>300nm	160	66	[1]
Rutile (R1)	0.2wt%Pt	300W Xe lamp	497	244	[2]
Rutile (R2)	0.2wt%Pt	300W Xe lamp	451	221	[2]
Rutile (R3)	0.2wt%Pt	300W Xe lamp	481	234	[2]
Rutile TiO_2	0.1wt%Pt	>350nm	142	66	[3]
Rutile TiO_2	1wt%Pt	>350nm	14	7	[3]
Rutile (R1-1273)	0.1wt%Pt	>350nm	344	147	[4]
Rutile (R1-1473)	0.1wt%Pt	>350nm	37	18	[4]
Rutile (R2-1273)	0.1wt%Pt	>350nm	trace	0	[4]
Rutile (R3-1273)	0.1wt%Pt	>350nm	235	102	[4]
Rutile (*Large*)	1wt%Pt	300W Xe lamp	549	252	This work
Rutile (*Middle*)	1wt%Pt	300W Xe lamp	783	369	This work

Rutile (*Small*)	1wt%Pt	300W Xe lamp	1229	549	This work

References.

1. K. Maeda, *Chem. Commun.*, 2013, **49**, 8404-8406.
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