

Electronic Supporting information

BiOI/TiO₂ nanotube arrays, a unique flake-tube structured p-n junction with remarkable visible-light photoelectrocatalytic performance and stability

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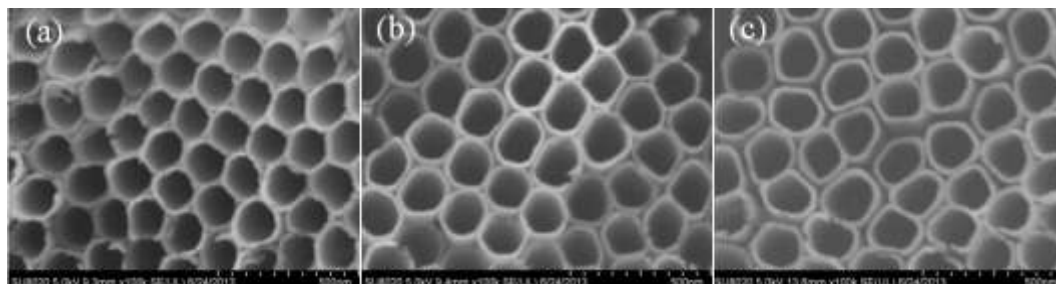
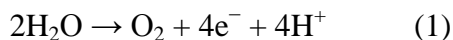


Fig.S1. Top surface FESEM images of the bare TNTAs fabricated under the same process conditions except different proportion of water in electrolyte: (a) 6 vol. %, (b) 8 vol. %, and (c) 10 vol. %.

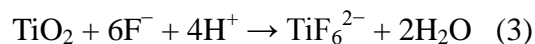
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The possible mechanism of intertube spacing increases

As reported previously, the formation mechanism of TiO₂ nanotubes in fluorinated electrolyte mainly followed the three reactions:



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The formation of pores results from partial chemical dissolution of pre-generated TiO₂ by F⁻, according to the reaction (3). Higher proportion of water in electrolyte leads to higher concentration of H⁺ according to Reaction (1), thereby accelerating the chemical dissolution of TiO₂ in the gaps among
15 the pores. Therefore, nanotubes are free-standing with large intertube spacings at high proportion of water in electrolyte.

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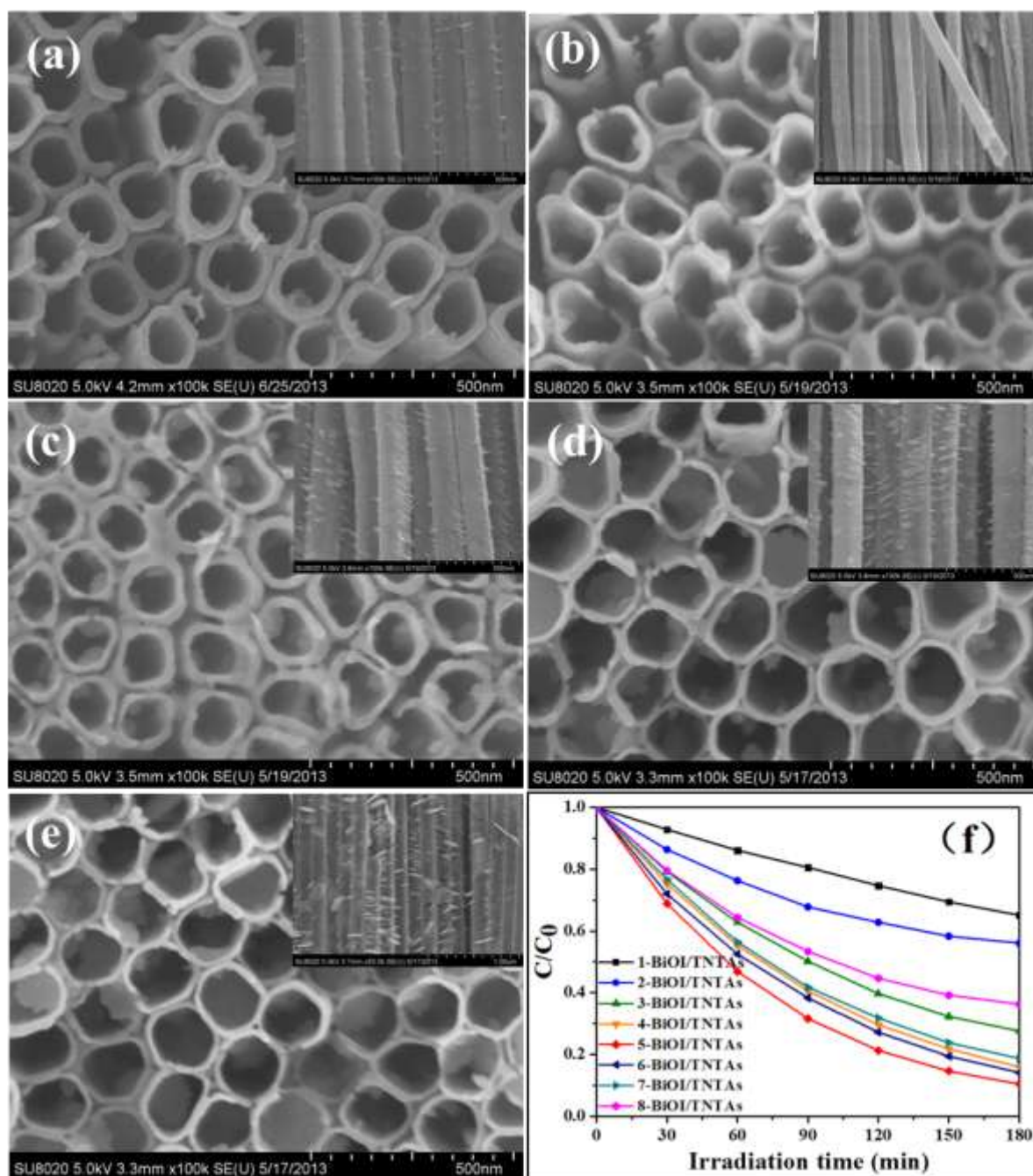
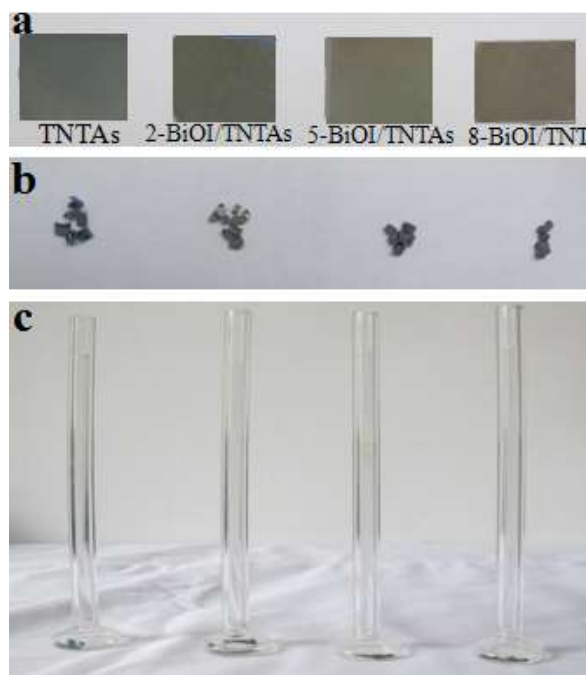


Fig.S2 Top and side (inset) view SEM images of as-prepared BiOI/TNTAs samples, 1-BiOI/TNTAs (a), 3-BiOI/TNTAs (b), 4-BiOI/TNTAs (c), 6-BiOI/TNTAs (d) and 7-BiOI/TNTAs (e), the PEC activities of all the BiOI/TNTAs samples under visible-light irradiation.

Relative BET surface area measurement

The Redundant part of titanium foil without anodic oxidation was firstly cut off from the resulting samples (Fig.S3a). It was clear that the color of the surface films gradually turned red with increasing deposition cycles, which was attributed to the increase in the amount of the red BiOI loaded onto the TNTAs. Then the obtained rectangular samples were cut into fine shreds and rolled up (Fig.S3b), subsequently putted into the test quartz tube to measure the Nitrogen adsorption isotherms (Fig.S3c). If ignore the density differences between the Ti substrate and surface films, the relative BET surface area of the TNTAs and 2, 5, 8-BiOI/TNTAs samples can be calculated via multiplying the measured data by the sample quality and then divided by the sample area, as listed in Table S1.



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Fig.S3 Measurement process of the relative BET surface area for the as-prepared TNTAs and 2, 5, 8-BiOI/TNTAs samples

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Table S1. Relative BET surface areas of Ti foil and the as-prepared TNTAs and 2, 5, 8-BiOI/TNTAs films samples attached to the Ti substrate

samples	Relative BET specific surface area ($\text{m}^2/\text{cm}^2_{\text{Ti}}$)
Ti foil	2.5310×10^{-4}
Bare TNTAs	0.2732
2-BiOI/TNTAs	0.3926
5-BiOI/TNTAs	0.7384
8-BiOI/TNTAs	0.5925

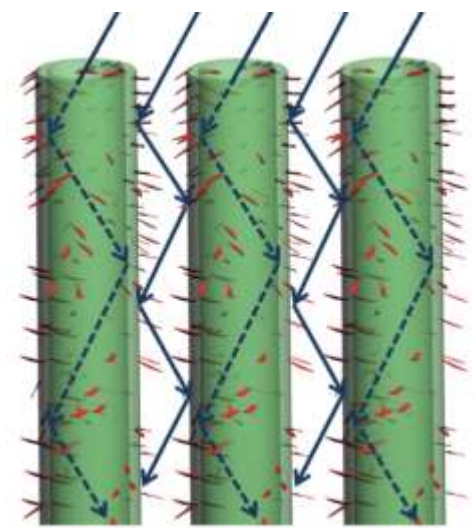


Fig.S4 Schematic illustration of the light multiple reflections in the 5-BiOI/TNTAs sample with plenty of BiOI nanoflakes dispersing on both outer and inner walls of well-separated TiO_2 nanotubes