

## Supporting Information for

### Synthesis and Self-Assembly of Photonic Materials from Nanocrystalline Titania Sheets

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## Experimental

### Sample preparation

Layered TiO<sub>2</sub> nanosheets with exposed {001} facet

In a typical reaction, we mix TiF<sub>4</sub> (0.10 g) in 40 mL of benzyl alcohol (molar ratio of TiF<sub>4</sub> : benzyl alcohol, 1 : 500) until we obtain a homogeneous solution (~2 h). We then transfer the solution to a 50 mL Teflon-lined stainless steel autoclave and heat for 24 h at 160 °C. After cooling, we collect the white, crystalline titania powder by centrifugation and then wash it with ethanol.

Colourful TiO<sub>2</sub> film on Ti foil

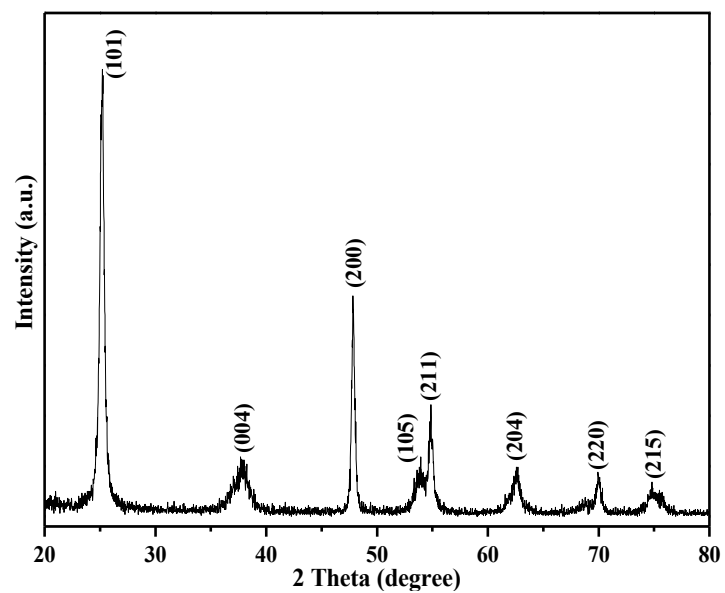
In a typical reaction, we mix TiF<sub>4</sub> (0.010 g) in 40 mL of benzyl alcohol until we obtain a homogeneous solution (~2 h). Then additional 5 mL Tert.-butyl alcohol was added. The clear solution was transferred to a 50 mL Teflon-lined stainless steel autoclave and heat for 24 h at 130 °C. After cooling, we collect colourful TiO<sub>2</sub> film on Ti foil and then wash it with ethanol.

TiO<sub>2</sub> film on Ti foil by Sol-gel method

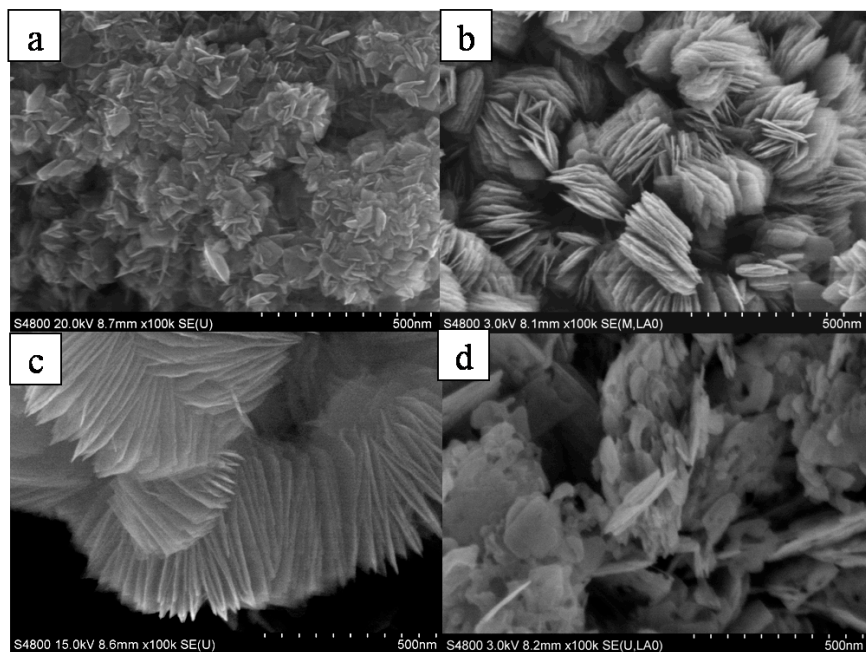
In a typical reaction, we mix tetrabutyl titanate (2 mL) in 50 mL of ethanol containing 2.5-mL dilute HNO<sub>3</sub> solution (1:5 V/V) until we obtain a homogeneous solution (~2.0 h). The clear solution was coated on a glass slide by a spinning coating method. The obtained glass was calcined at 400 °C for 3 h to remove organic compounds and obtain crystalline TiO<sub>2</sub> film.

### Characterization.

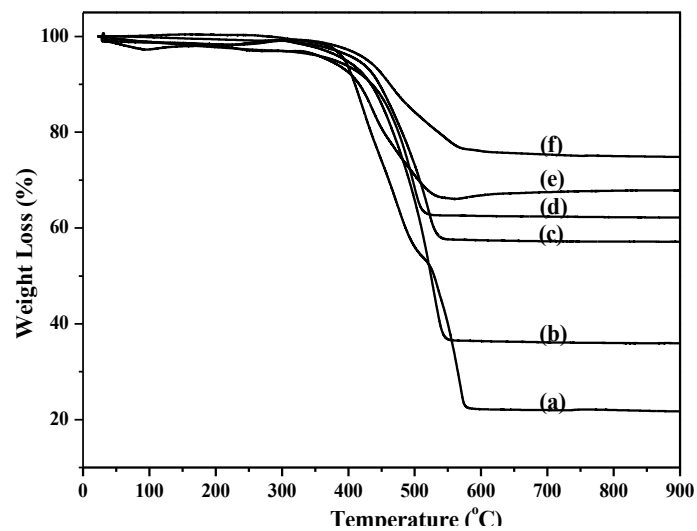
The structure of the materials was characterized using X-ray diffraction (XRD, D/MAX-2000 with CuK $\alpha$  radiation). The morphology was shown in scanning electron microscopy (SEM, HITACHI S4800) and transmission electronic micrograph (TEM, JEOL JEM-2100, operated at 200 KV) analyses. UV-vis diffuse reflectance spectra (DRS) were obtained on a UV-vis spectrophotometer (DRS, MC-2530), using BaSO<sub>4</sub> as a reference. The FTIR spectra were recorded by a Fourier transform infrared spectroscopy (NEXUS 470).



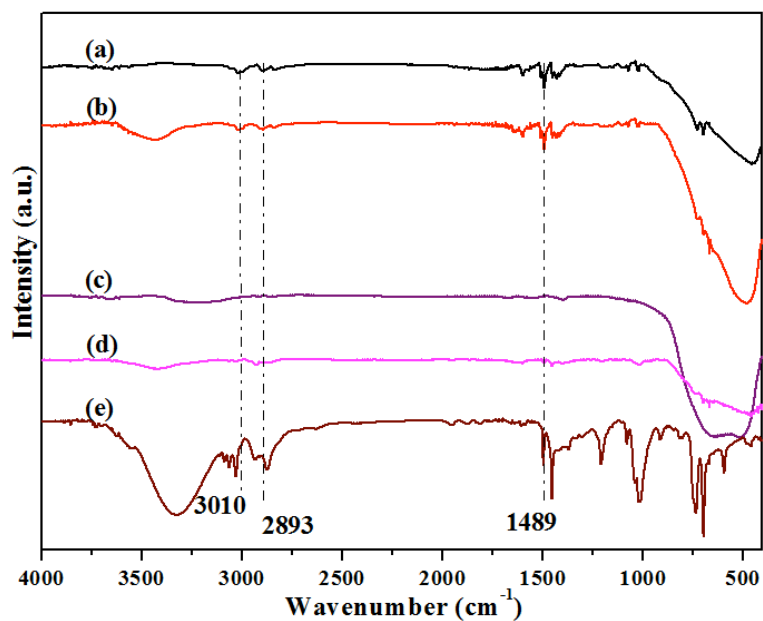
**Figure S1.** XRD pattern of TiO<sub>2</sub> nanoplates after solvothermal reaction at 160 °C for 24 h.



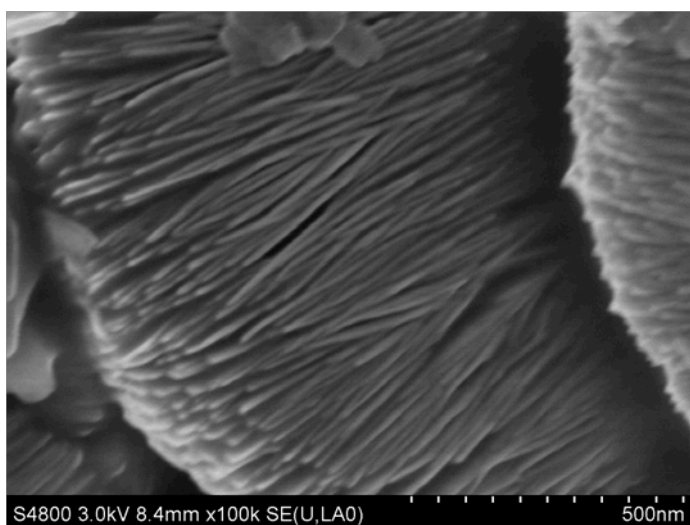
**Figure S2.** SEM images of TiO<sub>2</sub> samples with different mol ratio of TiF<sub>4</sub> and benzyl alcohol synthesized at 160 °C for 24 h. (a) 1 : 4800, (b) 1 : 1200, (c) 1 : 600, (d) 1 : 240.



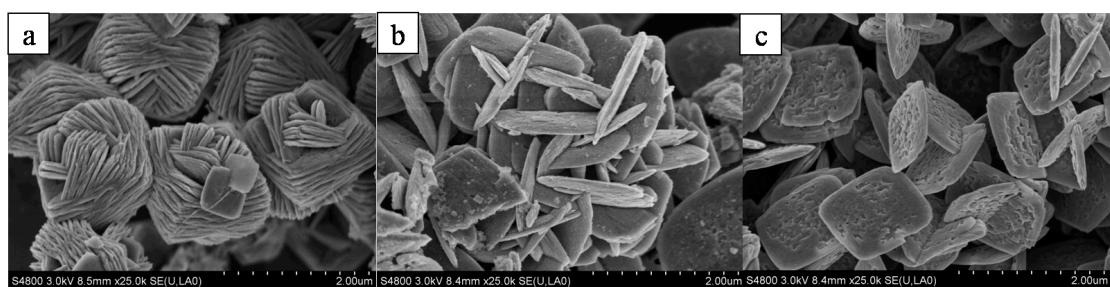
**Figure S3.** TG Analysis of TiO<sub>2</sub> nanoplates synthesized at 160 °C for (a) 3, (b) 5, (c) 8, (d) 12, (e) 18, (f) 24 h. The weight loss of these samples is 78%, 64%, 43%, 38%, 33% and 24% respectively.



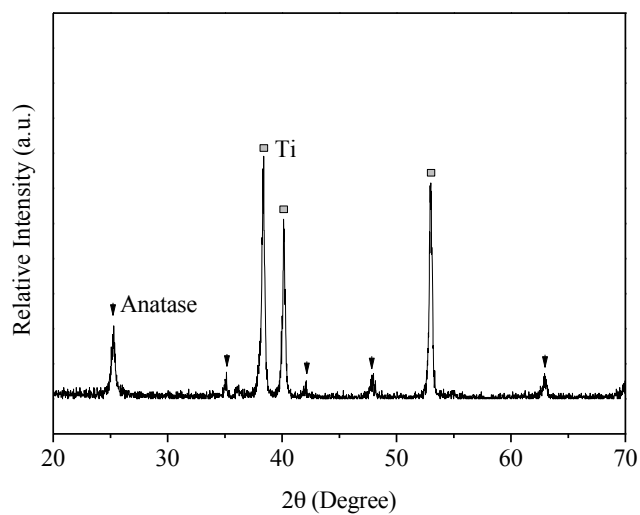
**Figure S4.** FTIR spectrum of layered TiO<sub>2</sub> nanoplates synthesized at 160 °C for (a) 12 h, (b) 24 h. Pure (c) and benzyl alcohol adsorbed (d) commercial P-25 TiO<sub>2</sub> samples. (e) Pure benzyl alcohol.



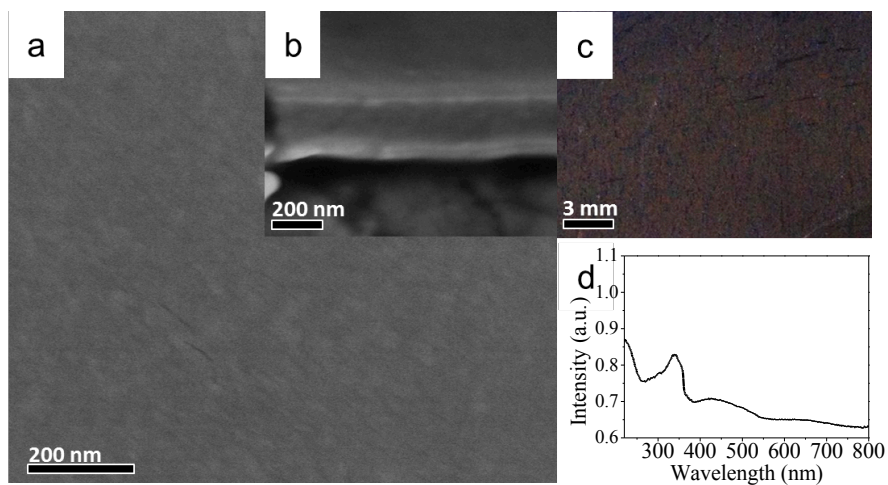
**Figure S5.** SEM image of TiO<sub>2</sub> samples from pentafluorobenzyl alcohol and benzyl alcohol synthesized (1:1 v/v) at 160 °C for 24 h.



**Figure S6.** SEM images of TiO<sub>2</sub> samples from p-fluorobenzyl alcohol (a), p-chlorobenzyl alcohol (b) and p-bromine benzyl alcohol (c) synthesized at 160 °C for 24 h.



**Figure S7.** XRD pattern of TiO<sub>2</sub> film on Ti foil.



**Figure S8.** (a) Top view SEM. (b) Cross-sectional SEM of TiO<sub>2</sub> film on Ti foil by Sol-gel method. (c) Optical micrograph. (d) UV-Vis diffuse reflectance spectra of TiO<sub>2</sub> film grown on Ti foil by Sol-gel method.