Electronic Supplementary Information for

WO_3 modified titanate network film: highly efficient photo-mineralization of 2-propanol under visible light irradiation

Experimental

Preparation of STN, and WO_3-STN network films: Ti foil (99.9% of purity and 12.7 μm in thickness) with a size of 1.5 × 1.5 cm^2 was put into an antoclave containing a concentrated NaOH aqueous solution (10 $mol \cdot L^{-1}$), and then reacted at 110 °C for 24 h by a hydrothermal method. After cooling down, the obtained STN film was washed with distilled water and ethanol for several times, and was dried. Appropriate amount of H_2WO_4 was dissolved into the dilute ammonia to form a solution with the concentration of 0.05 mol L^{-1}. Then put the STN film into the above solution, and react in an autoclave at 80 °C for 10 h. After reaction, the WO_3-STN film was washed with water and dried. At last, the WO_3-STN film was calcined at 450 °C for 30 min in air.

For comparison, the TiO_2 film was obtained by heating Ti foil in an oxygen atmosphere at 450 °C for 30 min. And the WO_3-TiO_2 film was prepared by the similar method as the WO_3-STN film.

Photocatalytic activity evaluation for IPA photodegradation: The reactor volume was 500 mL, and the container was equipped with a pyrex lid as a window. The photocatalyst films were placed in the bottom of the Pyrex reactor. The light source is a 300 W Xe arc lamp with an L-42 (Hoya Corp., Japan) cutoff filter and a water filter; the intensity of the incident light was measured to be 28 $mW \cdot cm^{-2}$ with a spectroradiometer (USR-40, Ushio Inc., Japan). Before irradiation, the reactor was kept in dark for some time to ensure an adsorption-desorption equilibrium of gaseous reactants on the sample. The concentrations of IPA, acetone, and CO_2 were measured using a gas chromatograph (GC-14B, Shimadzu) equipped with a flame ionization detector (FID) and a methanizer. (Porapak Q and PEG-1000 columns were used for detection of CO_2 and the two organic gases (IPA and acetone)).

Photoelectrochemical property measurement: The photocurrent-time curve was carried out using a conventional three-electrode. The network films served as the working electrode, and Pt electrode and saturated calomel electrode (SCE) acted as the counter electrode and reference electrode, respectively. The electrolyte was Na_2SO_4 with a concentration of 0.1 mol L^{-1}, and the pH value of the electrolyte was 6.4. The photoelectrochemical experiments were performed using an electrochemical analyzer (CHI-650A, ALS/CH Instrument, Japan). The photocurrent was measured at the applied potential of 0 V, and the scan rate was 10 s^{-1}. The light source is a 500 W Xe arc lamp with an L-42 (Hoya Corp., Japan) cutoff filter, and the intensity of the incident light was tested to be 90 $mW \cdot cm^{-2}$ with a spectroradiometer (USR-40, Ushio Inc., Japan).

Characterization of the photocatalyst films

The crystal structures of the films were determined with an X-ray diffractometer (XRD; RINT 2000, RIGAKU Co., Japan) operated at 30 KV and 40 mA using Cu Kα radiation (λ = 1.54718 Ǻ). The scanned range was 2θ = 5-80°, with a speed of $0.1^\circ \cdot min^{-1}$. The UV-vis diffusion reflectance spectra of the samples were analyzed by a UV-vis spectrophotometer (UV-2500, Shimadzu Co., Japan) with barium sulfate as the reference at room temperature and transformed to the absorption spectra according to the Kubelka-Munk relationship. The morphology photographs of the samples were obtained by SEM (JSM-6700F; JEOL Co., Japan) and TEM (JEOL-JEM 2100; JEOL Co., Japan). The atomic ratios in the photocatalysts were measured by energy dispersive X-ray spectrometer (EDS; EX-64165JMU; JEOL Co., Japan). The surface area was determined on a Gemini 2360 surface area analyzer (Micromeritics, Co., USA) by nitrogen absorption at 77 K using the BET method.

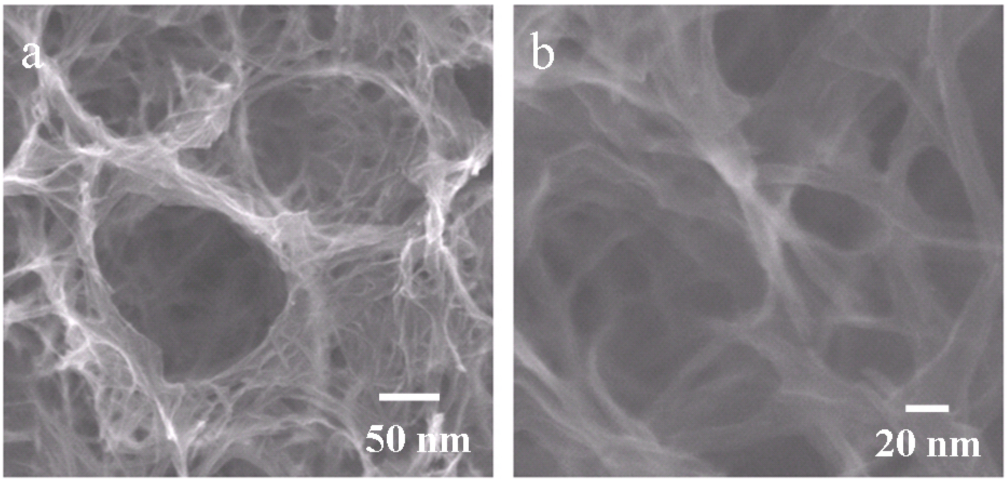

Fig. S1 High resolution SEM images of STN films

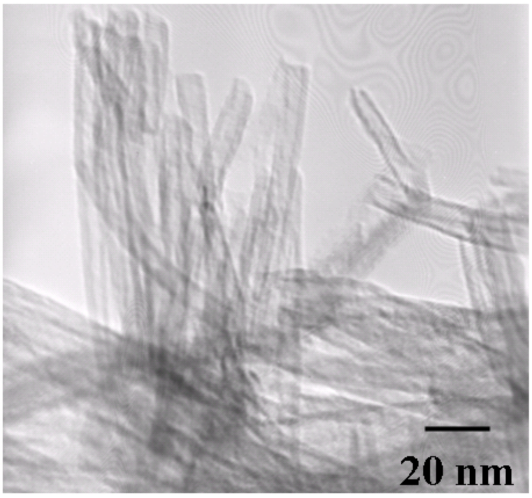

Fig. S2 TEM image of STN nanotubes

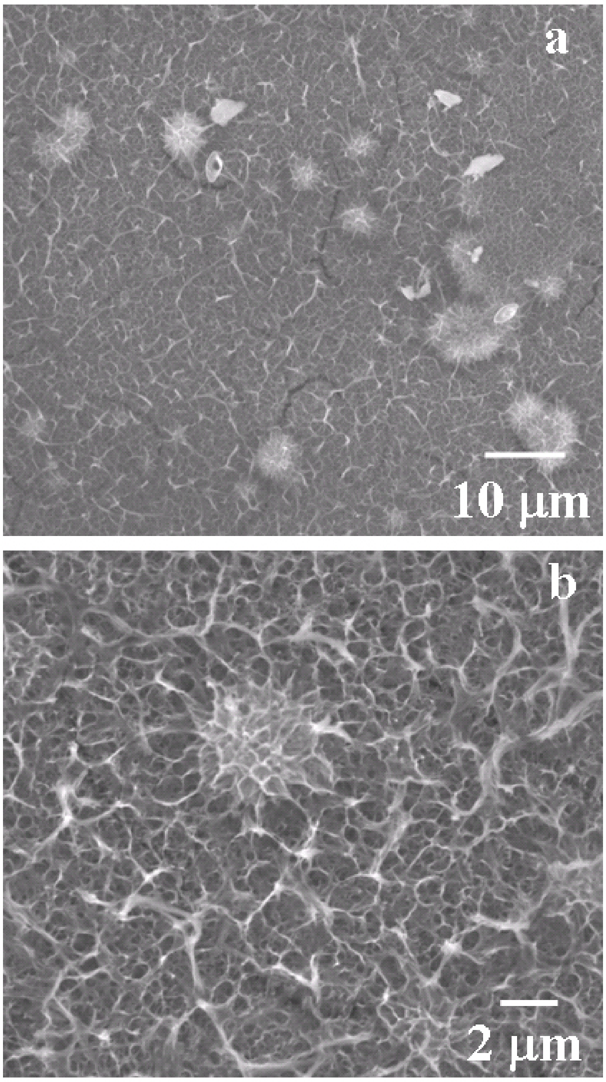

Fig. S3 TEM images of WO_3-modified STN network film

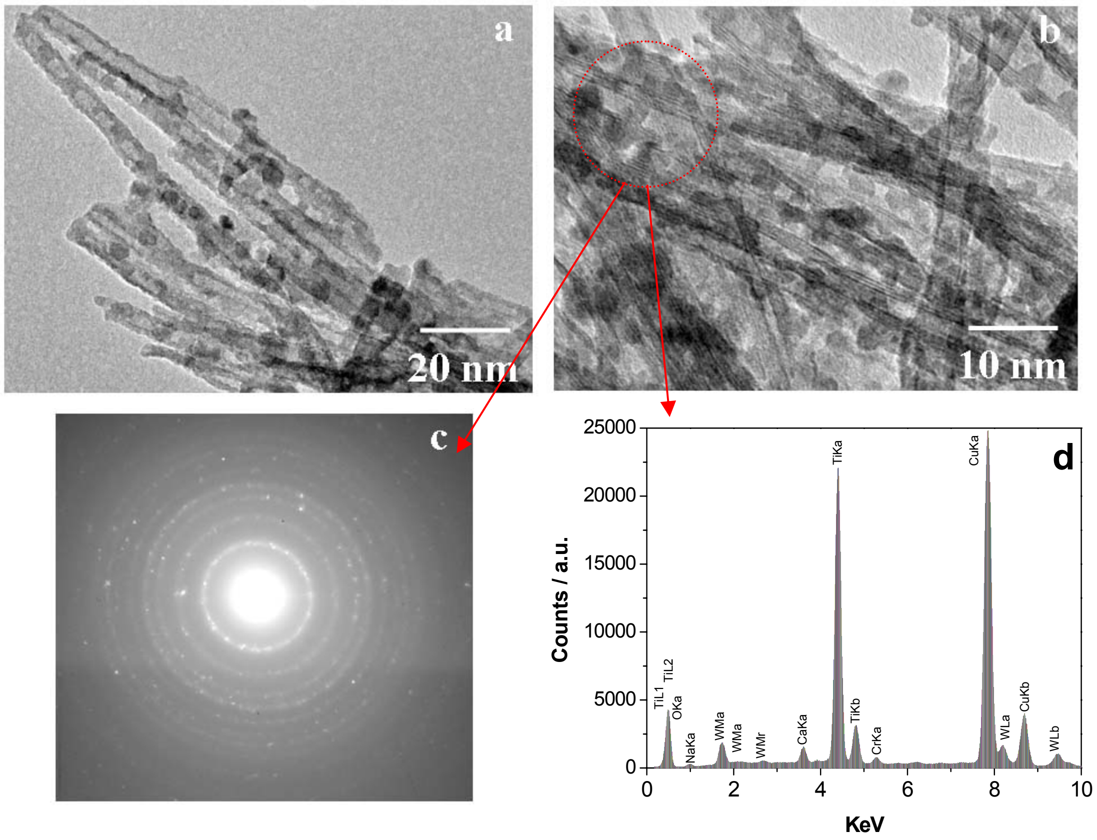

Fig. S4 TEM images (a, b), selected area electron diffraction pattern (c) and corresponding EDS spectrum of WO_3- modified STN nanotubes

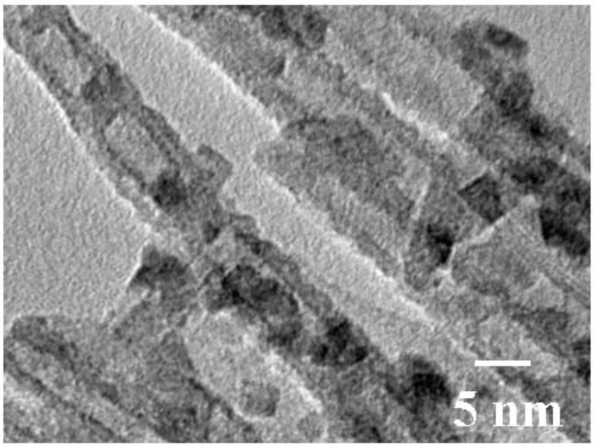

Fig. S5 HRTEM image of WO_3-modified STN nanotubes

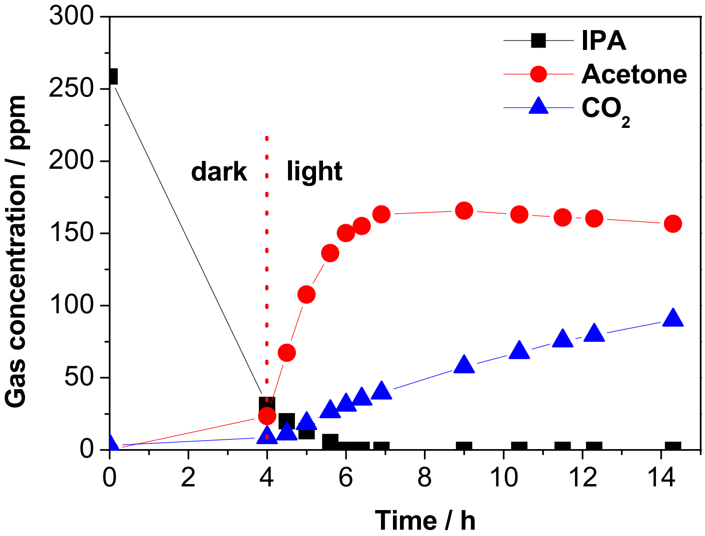

Fig. S6 Photocatalytic activity of IPA degradation by the Pt-loaded STN film under visible light ($\lambda \geq 420$ nm) irradiation.

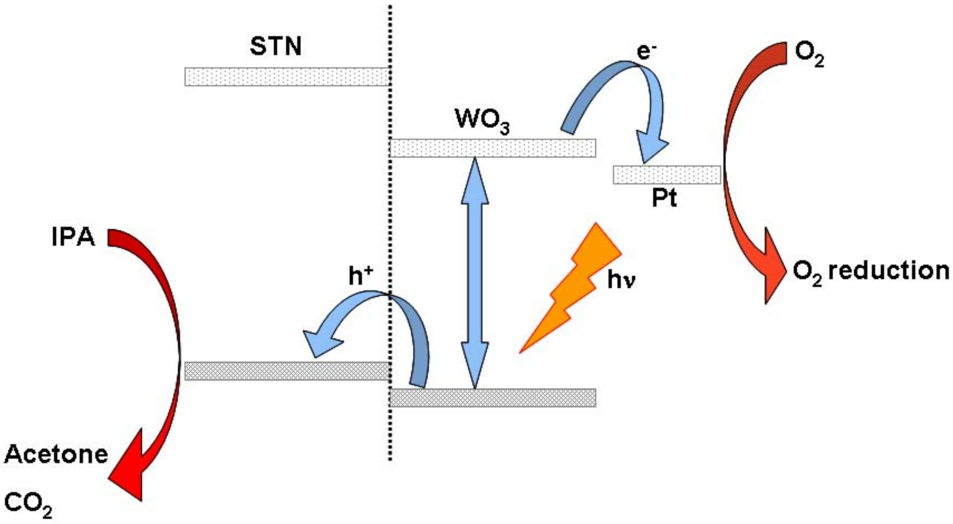

Fig. S7 Photocatalytic reaction mechanism of IPA decomposition by WO_3-STN film under visible light (λ≥ 420 nm) irradiation

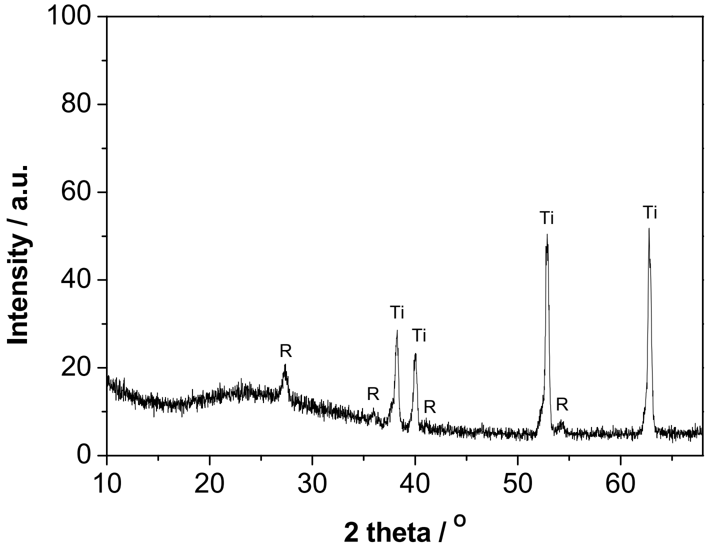

Fig. S8 XRD pattern of WO_3-TiO_2 film

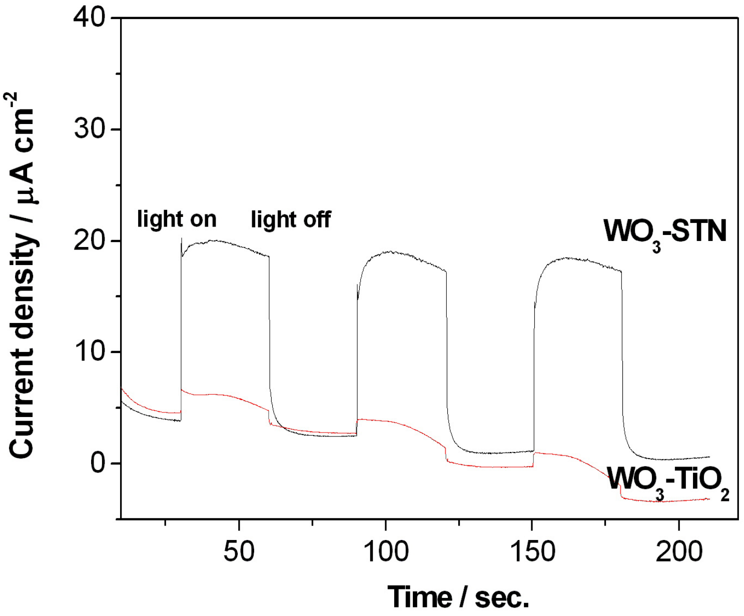

Fig. S9 Photocurrent-time curves of WO_3-STN and WO_3-TiO_2 films under visible light (λ≥ 420 nm) irradiation. The applied potential was 0 V, and the scan rate was 10 s^{-1}.

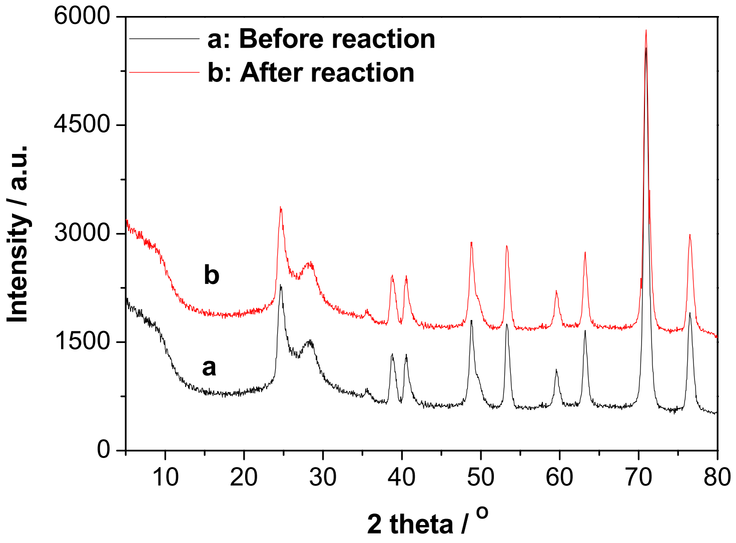

Fig. S10 Comparison of the XRD patterns of Pt-loaded WO_3-STN film before and after reaction.