Supplementary Material (ESI) for Chemical Communications

Electronic Supplementary Information

Substrate-free, large-scale, free-Standing and two-side oriented single crystal TiO_2 nanorod array films with photocatalytic properties

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Characterisation and photocatalytic activity measurements

The morphology of TiO_2 nanowire array films was observed by thermal field emission environment scanning electron microscope (FESEM; Quanta 400). The crystal structure of the samples was analyzed using X-ray diffraction (XRD, Bruker) with Cu Kα radiation. Transmission electron microscopy (TEM) observations were carried out with a high-resolution transmission electron microscope (JEOL, JEM-2010). The BET surface area of samples was measured by nitrogen adsorption-desorption apparatus (Micromeritics, ASAP 2000).

The photocatalytic activity of single crystal nanorod film was evaluated through degradation of methyl orange in a photochemical reactor (BLGHX-V, Xi'an Depai Biotech. Co. Ltd., China). Irradiation was provided by a 300 W medium pressure Hg-lamp (E_{nmx}=365 nm). 20 mg of catalyst was added to 50 mL of methyl orange aqueous solution (initial concentration: 6 mg/L). To immobilize methyl orange on the nanorod arrays, the samples were immersed in the solution for 30 min. At regular intervals, 2.5 ml of the solution was collected and centrifuged. Then, the concentration of methyl orange was determined spectrometrically from a calibration curve of the absorption at λ= 464 nm by a UV-Visible-NIR spectrophotometer (Hitachi, U-4100). For comparison, the same procedures were also done for the compacted P25 film and polycrystalline nanowire film in the same amount.

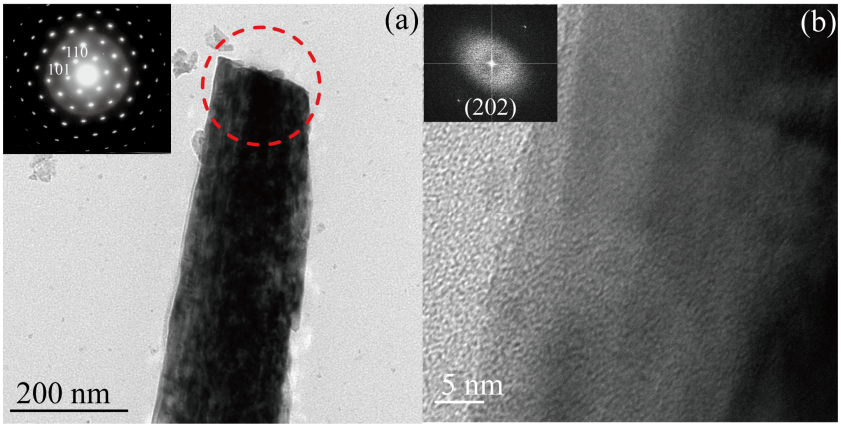

Fig. S1 (a) Low resolution TEM image of an individual broken TiO_2 nanorods; (b) HRTEM image obtained along the [1 $\bar{1}$ 1] zone axis. Inset is its corresponding fast Fourier transform pattern.

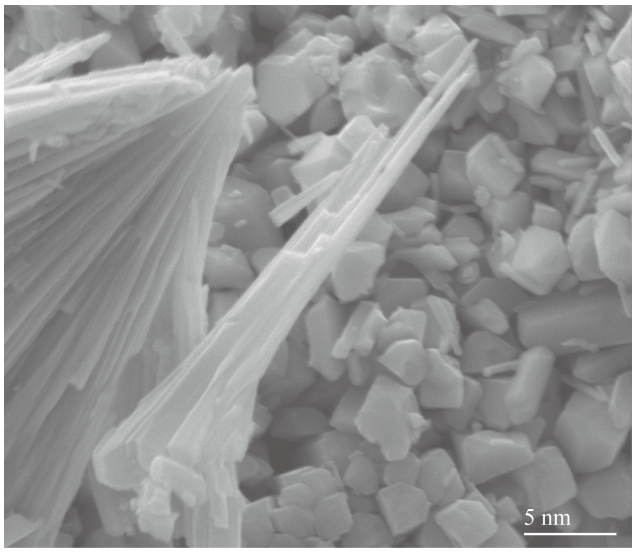

Fig. S2 SEM image of the broken TiO_2 rutile nanorods.

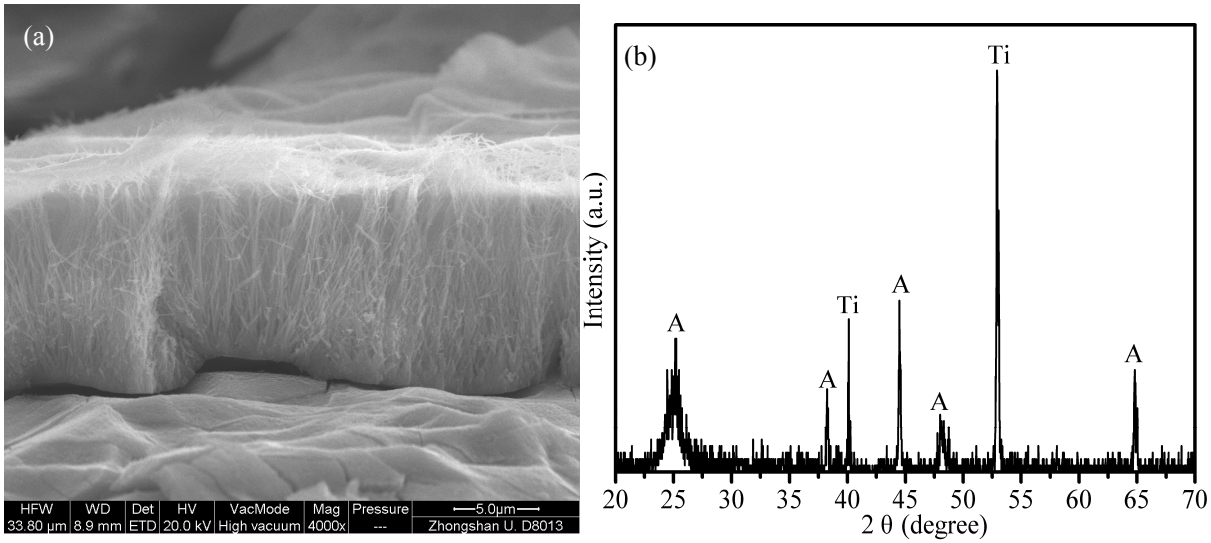

Fig. S3 Side view SEM image (a) and XRD patterns (b) of polycrystalline anatase TiO_2 nanowire film.

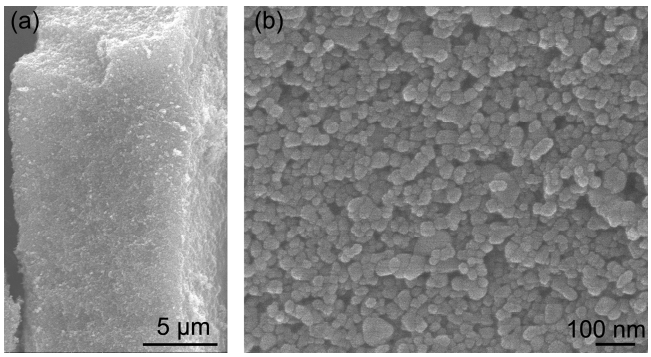

Fig. S4 SEM images of Degussa P25 layer. (a) low magnification; (b) high magnification.

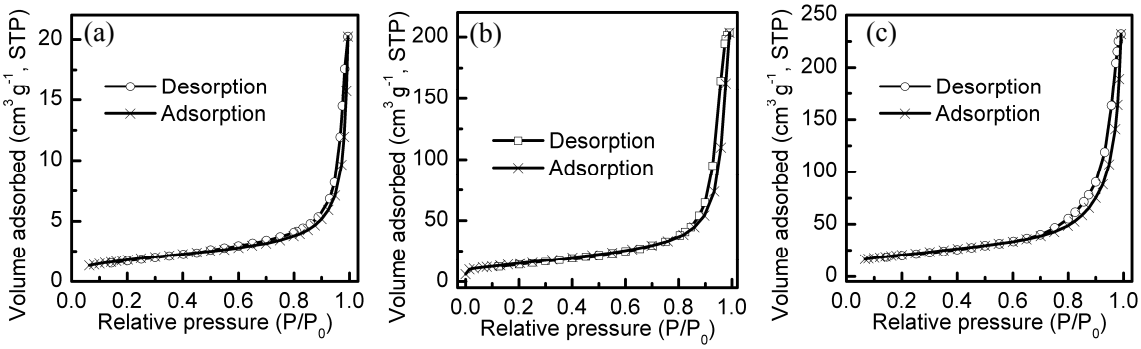

Fig. S5 Nitrogen adsorption-desorption isotherms for single crystal nanowire (a); P25 (b); and polycrystalline nanowire materials (c). Specific surface areas were calculated via the Brunauer–Emmett–Teller (BET) model. The measured BET surface area of single crystal nanorod, P25, and polycrstalline nanowire materials is 6.63 m^2/g, 54.71 m^2/g and 73.86 m^2/g, respectively.