Supplementary Information for

Synthesis of Single-Crystalline Anatase Nanorods and Nanoflakes on Transparent Conducting Substrates

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Experimental Section:

Materials Preparation:

In a typical synthesis, 5 ml of liquid $TiCl_4$ was added to a 10 ml glass beaker inside a Teflon-lined stainless steel autoclave (125 ml volume, Parr Instrument Co.). Three pieces of FTO coated glass substrates (F:SnO_2, Tec 15, 10 Ω/□, Hartford Glass Company), cleaned ultrasonically for 60 minutes in a mixed solution of deionized water, acetone, and isopropanol with volume ratios of 1 : 1 : 1, were placed at an angle against the wall of Teflon-liner in between the space of the glass beaker and the Teflon-liner with the conducting side facing up. The autoclave was sealed and kept inside an oven at 90 – 150 °C for 1 – 3 days. Following, the autoclave was cooled naturally to different temperatures to allow the $TiCl_4$ vapors to condense. The FTO substrates were removed from the autoclave and kept in the ambient environment for a few seconds before being placed in an oven maintained at 100 °C. Finally, the titania coated FTO substrate was heated to 450 °C at different heating rates to convert amorphous titania into crystalline anatase. The process was robust with respect to the synthesis parameters but very sensitive to the temperature at which the autoclave was opened to ambient air.

Materials Characterization:

The crystal structure of the as-prepared film was examined by X-ray diffraction (XRD). The XRD patterns were recorded in a Bruker-AXS Microdiffractometer (Model D5005) with Cu K_α radiation (λ = 1.5406 Å) from 20° to 70° at a scanning speed of 2.4°/min. X-ray tube voltage and current were set at 45 kV and 40 mA, respectively. Morphological, lattice structural, and chemical compositional information were examined with field emission scanning electron microscopy with energy dispersive X-ray spectroscopy (FESEM/EDX, JSM-6500F, and JSM-6700F), transmission electron microscopy, selected area electron diffraction, and

high-resolution transmission electron microscopy (TEM/SAED/HRTEM, FEI Tecnai G2 30).

Solar Cell Assembly and Characterization:

Dye-sensitized solar cells (DSSCs) were assembled by using the TiO_2 nanorods or nanoflakes grown on FTO as the photoanode. Prior to dye adsorption, the as-prepared film was immersed in an aqueous $TiCl_4$ solution at 50 °C for 2 hours. The $TiCl_4$ solution was prepared by mixing 0.09 ml of $TiCl_4$ with 0.4 ml of concentrated hydrochloric acid (36.5% – 38% by weight) followed by the addition of deionized water to reach a final volume of 100 ml. After rinsing with deionized water, the $TiCl_4$-treated substrate was annealed in air at 450 °C for 30 minutes. The sensitizer used in this work was *cis*-bis(isothiocyanato)bis(2,2′-bipyrridyl-4-4′-dicarboxylato)-ruthenium(II)bis-tetrabutylammonium dye (N-719 as received from Solaronix). Both the nanorod and nanoflake films were then immersed in a 0.3 mM solution of N719 in ethanol for 24 hours. After dyeing, the substrates were rinsed with pure ethanol and dried in ambient air for 30 minutes. DSSCs were assembled by pressing FTO substrates coated with 10 nm platinum against the nanorod or nanoflake substrates. The electrodes were separated by 25 μm Teflon spacers (Pike Technologies). The liquid electrolyte Iodolyte MPN-100 (Solaronix) was injected into the space between the anode and the cathode through capillary forces.

The current-voltage (*I-V*) characteristics of the solar cells were recorded with a Keithley 2400 sourcemeter using a simulated AM1.5 spectrum produced by a homemade solar simulator. No corrections were made for reflection from the glass substrates, and the solar cell area was defined with a 0.33 cm^2 circular aperture.

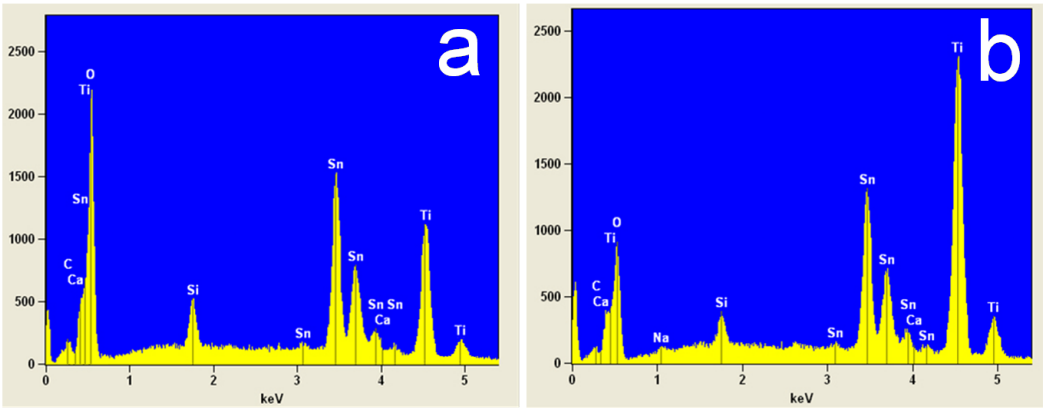

Figure SI-1. EDX spectrum (counts versus electron energy) of TiO_2 nanostructured film (a) before thermal treatment, and (b) after thermal treatment.

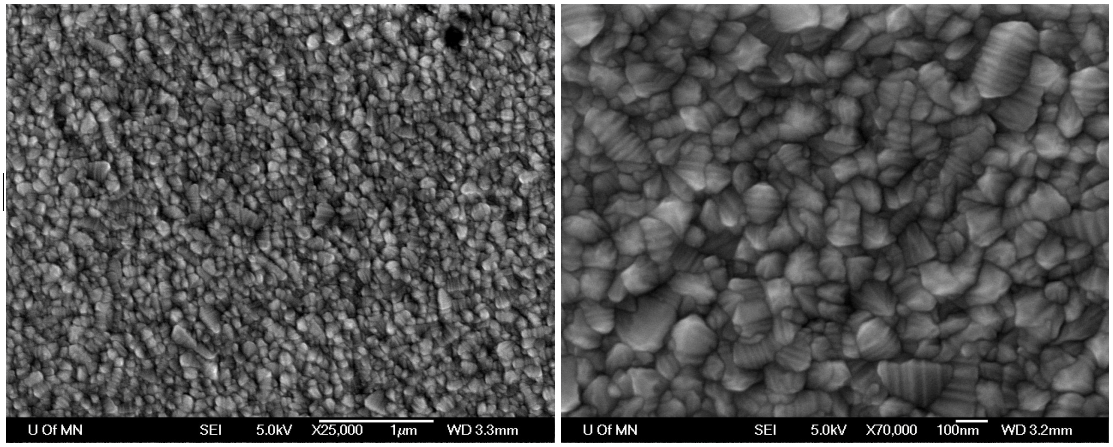

Figure SI-2. Top view FESEM images of FTO substrate showing the surface roughness.