Supporting Information

97 Percent Light Absorption in an Ultrabroadband Frequency Range Utilizing an Ultrathin Metal Layer: Randomly Oriented, Densely Packed Dielectric Nanowires as an Excellent Light Trapping Scaffold

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Experimental section

***Chemicals*:** All the chemicals were used were as received without further purification. Titanium (IV) butoxide ($Ti(OBu)_4$, 97%, Sigma–Aldrich), hydrochloric acid (HCl, 36%, Sigma–Aldrich) and HPLC-grade water (H_2O) are used in hydrothermal growth of TiO_2 nanowires on FTO coated glass (7 Ω sq^{-1}, Solaronix). Diethylzinc (DEZn, Sigma-Aldrich) and HPLC-grade water (H_2O) are used as the zinc and oxygen precursors in the ALD process, respectively.

***Hydrothermal Synthesis of TiO_2 Nanowire Arrays*:** TiO_2 nanowire arrays were synthesized by a hydrothermal process on FTO glass as described our previous study. Briefly, FTO glasses are cleaned in sonication baths in ethanol, acetone and de-ionized (DI) water each for 15 min and then dried by N_2 flow. In a typical process, HCl (20 mL) and DI water (20 mL) are stirred for 10 min in a teflon-lined stainless steel autoclave with a capacity of 45 mL. Then, 0.8 mL $Ti(OBu)_4$ is added in the solution and stirring additional 30 min under ambient conditions. FTO is placed into the autoclave with the conducting side facing up with 45° angle against. After autoclave maintained 140 °C for 5 hours allowed to cool the room temperature. The final products rinsed extensively with DI water to remove residues of solvents and dried in air.

***ALD Deposition Pt Shell Layer on TiO_2 Nanowire Arrays*:** Pt layer deposition is carried out at 200 °C in ALD reactor (Cambridge Nanotech Savannah S100). $MeCpPtMe_3$ was used as Pt atom precursor and ozone is eployed as oxygen agnet. These precursors are consecutively pulsed and purged into the chamber. The pulse and purge time for for Pt are 0.1s and 10s, respectively. The deposition of the shell layer was carried out using numbers of successive cycles with an estimated growth 0.8 Å per cycle to obtain a thickness of 10 nm.

***Structural Characterization*:** Scanning electron microscope (SEM, FEI – Quanta 200 FEG) operated at 10 kV and transmission electron microscope (TEM, Tecnai G2-F30, FEI) operated at 200 kV. TEM samples were dispersed in ethanol and prepared on a holey carbon coated copper grid. Selected area electron diffraction (SAED) analysis is also characterized to identify the growth direction and crystallinity of the nanowires.

***Optical Characterization*:** The normal reflection measurements for the wavelength range of 300 nm to 1000 nm were carried out employing an integrated sphere setup. The angle resolved reflection characterization was carried out using J.A. Woollam Co. Inc. VASE Ellipsometer for two different polarizations of TM and TE.

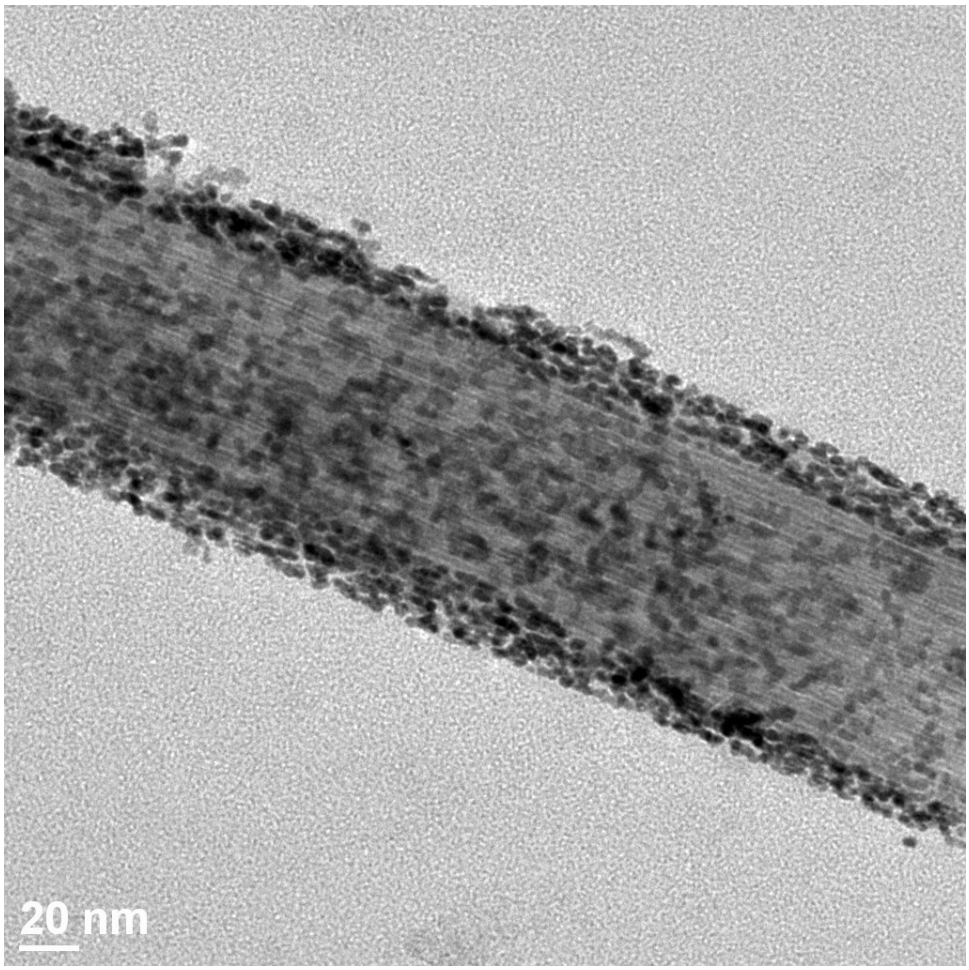

Fig. s1. TEM image of the Pt coated TiO_2 nanowires in the first ALD cycles where a contieous film has not been made.