Supporting Information

Power Conversion Efficiency Enhancement Based on the Bio-inspired Hierarchical Antireflection Layer in Dye Sensitized Solar Cell

Hyo-Jin Ahn, Sun-I Kim, Jong-Chul Yoon, Jung-Soo Lee and Ji-Hyun Jang*

Interdisciplinary School of Green Energy, KIER-UNIST Advanced Center for Energy, and Low Dimensional Carbon Materials Center, UNIST, Korea

Fabrication of 2D Diffraction Grating in Polymer

The substrates were cleaned using ultra-sonication with acetone, isopropanol, and de-ionized water for 10 min and dried by nitrogen blowing. A 100 nm thick photoresist film was obtained by spin-coating at 3000rpm on a $TiCl_4$ treated FTO substrate. 2D square patterns with circular holes were fabricated via interference lithography. The samples were double exposed for 6 x 6s by rotating the sample 90 degrees. Before developing the photoresist using PGMEA, a post-exposure bake was conducted at 55 °C for 10min. The diameter and pitch of the patterns were found to be 380 nm and 550 nm, respectively, from SEM measurements.

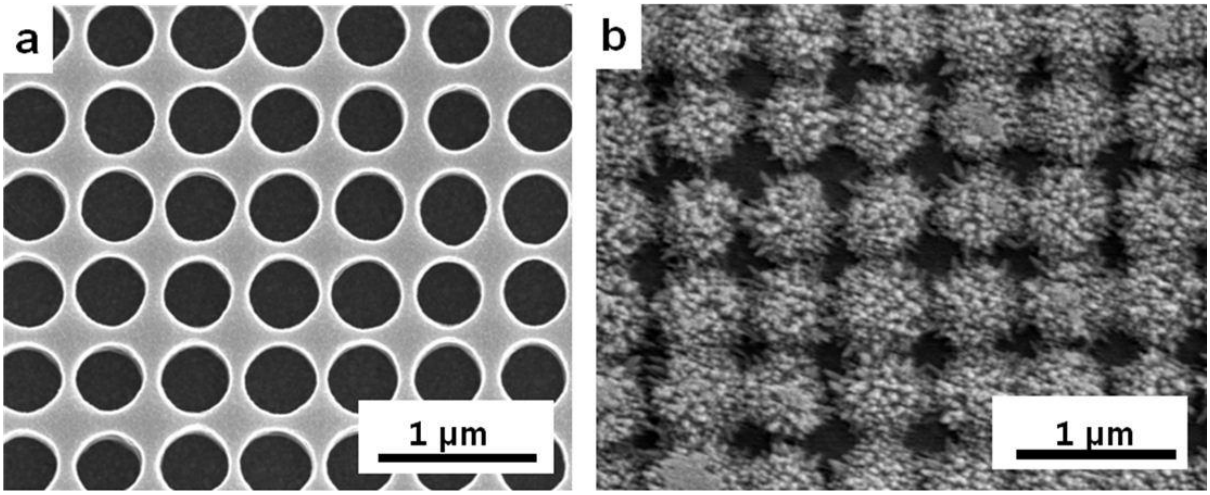

Figure S1: Low magnification SEM images of a) SU-8 pattern b) SU-8/TiO_2 NWs grown on SU-8 template

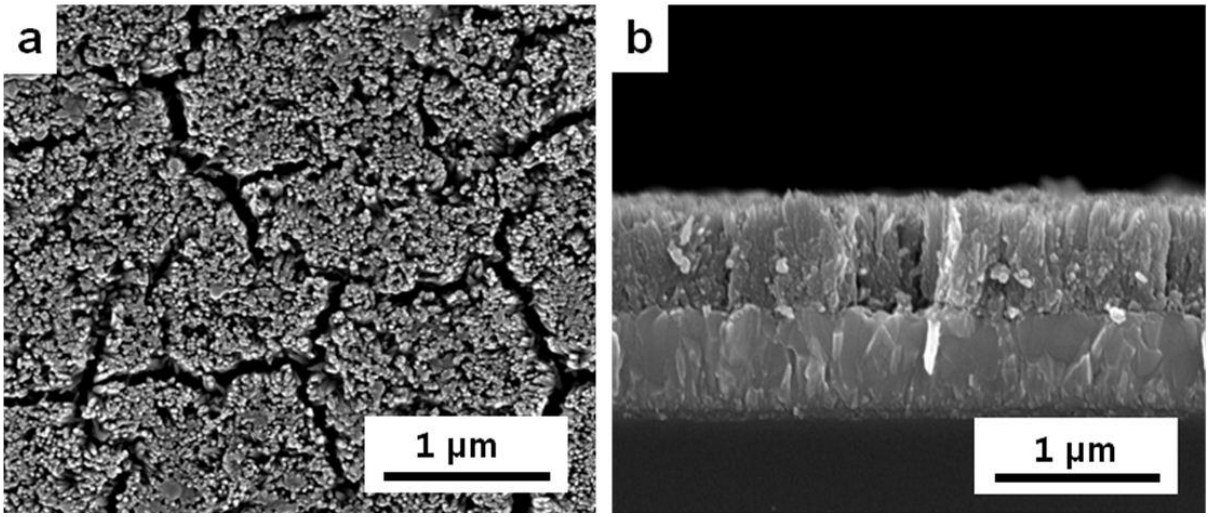

Figure S2. SEM images of a) TiO_2 NWs; b) Cross-sectional image of TiO_2 NWs

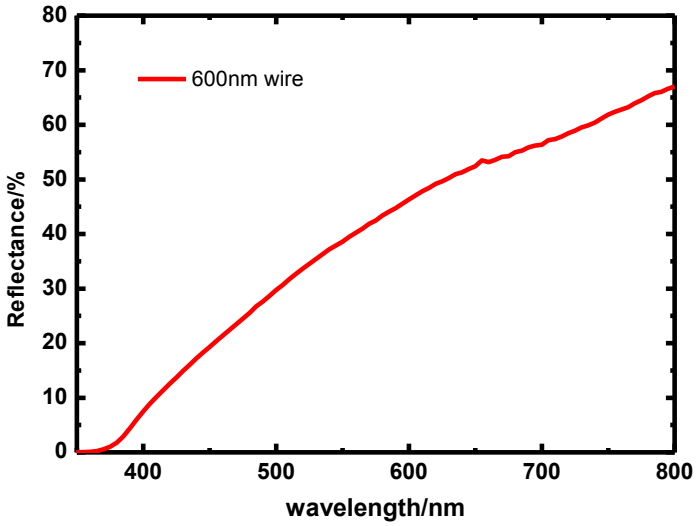

Figure S3. The reflectance of 600 nm TiO_2 NWs

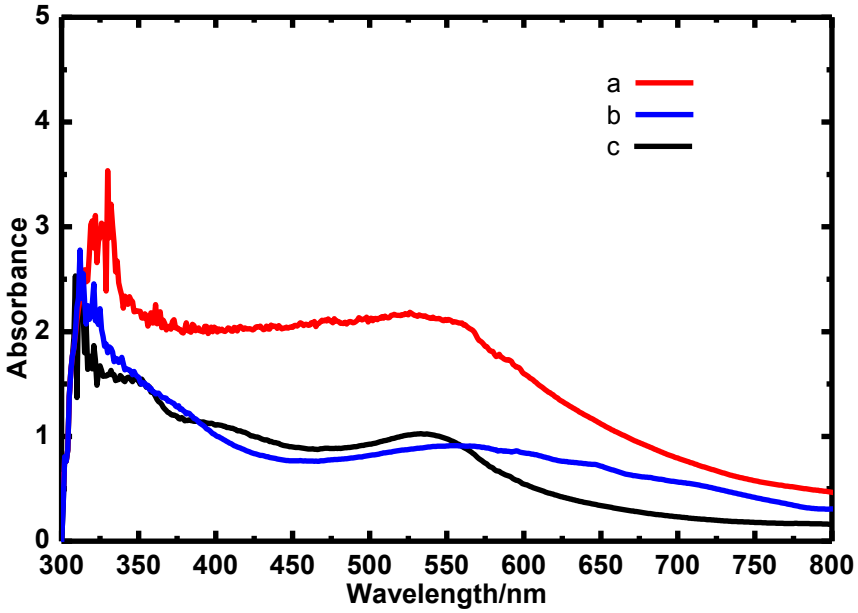

Figure S4. Absorbance spectra of TiO_2 NWs after N-719 dye absorption: a) 5.5 um hybrid structure; b) 500 nm TiO_2 NWs; c) 5 um NC-TiO_2 structure

Calculation of effective refractive index of AR layer

On the basis of the effective medium theory [1, 2], the effective refractive index n_{AR} can be approximated to be 1.967 by the equation

$$n_{AR} = [0.68 \times n_{TiO_2}{}^{q} + 0.32 \times n_{air}{}^{q}]^{1/q}, where\ q = 2/3$$

and the volume ratio of TiO_2:air = 0.68:0.32 from the SEM image.

1. Li, H. Y.; Jiang, B.; Schaller, R.; Wu, J. F.; Jiao, J., Antireflective Photoanode Made of TiO2 Nanobelts and a ZnO Nanowire Array. *Journal of Physical Chemistry C* 114, (26), 11375-11380.

2. Stavenga, D. G.; Foletti, S.; Palasantzas, G.; Arikawa, K., Light on the moth-eye corneal nipple array of butterflies. *Proceedings of the Royal Society B-Biological Sciences* **2006,** 273, (1587), 661-667.