

## Supporting Information

### Experimental Section

*Vapor phase polymerization of PEDOT:* 3,4-Ethylenedioxythiophene (EDOT, Aldrich) as a synthesis monomer of PEDOT, Iron(III) *p*-toluenesulfonate (FTS, Aldrich) as an oxidizing agent, were purchased and used without further purification. 1-butanol (JUNSEI) as solvents and 2-ethyl-4-methyl-imidazole (2-Et-4-Me-Im, Aldrich) as a weak base, were used as-received. Vikuiti™ Enhanced Specular Reflector (ESR, 3M) film was used as the substrate. The PEDOT film was directly prepared on FTS coated ESR substrate by vapor-phase polymerization (VPP) using EDOT monomer. The mixture of FTS and 2-Et-4-Me-Im (1:0.5 molar ratio) were dissolved in 1-butanol as 20 wt.-% by stirring the solution for about 10 minute. Above oxidant solution was uniformly coated by doctor blade onto ESR film. The oxidant coated ESR film was dried at 80 °C for 15 minute and then transferred to a VPP chamber. The chamber was purged with nitrogen gas for 60 minute before VPP. The nitrogen gas atmosphere was maintained throughout the polymerization at a flow rate of 500 mL per minute and then the chamber was heated to 80 °C. The EDOT monomer was placed at the bottom of the VPP chamber and oxidant coated film was exposed to the EDOT vapor for 10 min. After polymerization, the sample was soaked in distilled water to remove any un-reacted oxidant and EDOT. And then sample dried at room temperature.

*DSSC Assembly:* A commercialized TiO<sub>2</sub> paste was used to make a 13 μm-thick single-layer TiO<sub>2</sub> nanocrystalline films on the FTO substrate. After heat treatment at 500°C for 30 min, the nanocrystalline TiO<sub>2</sub> electrodes were immersed in 0.3 mM N719 dye solution. The dye-adsorbed photoanode and PEDOT only coated flat PES film or polymeric mirror film were assembled into a sealed sandwich-type cell by heating with a hot melt of polymer film (Surlyn, Dupont 1702). As an electrolyte, 0.6 M butylmethylimidazolium iodide, 0.03 M I<sub>2</sub>, 0.1 M guanidine thiocyanate, and 0.5 M 4-tert-butylpyridine in a mixture of acetonitrile and valeronitrile (v/v, 85:15) were prepared. Then,

one drop of the electrolyte solution was introduced into a hole drilled in the counter electrode of the assembled cell, followed by sealing the holes using a microcover glass and Surlyn.

*Impedance measurement:* Electrical impedance spectra were measured using an impedance analyzer (IM6) at an open-circuit potential under AM 1.5G one sun light illumination, with a frequency ranging from  $10^{-1}$  to  $10^6$  Hz. The magnitude of the alternative signal was 5 mV.

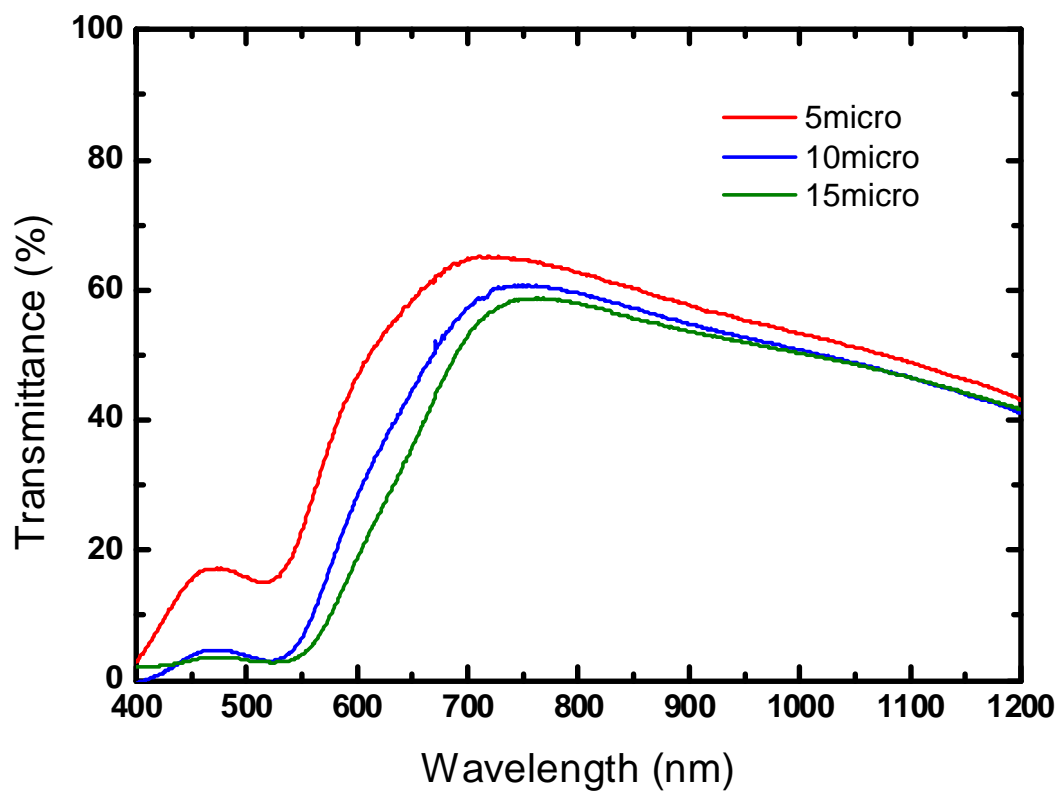


Fig S1. Transmittance behaviors of N719 covered TiO<sub>2</sub> nanoparticle photoanodes.

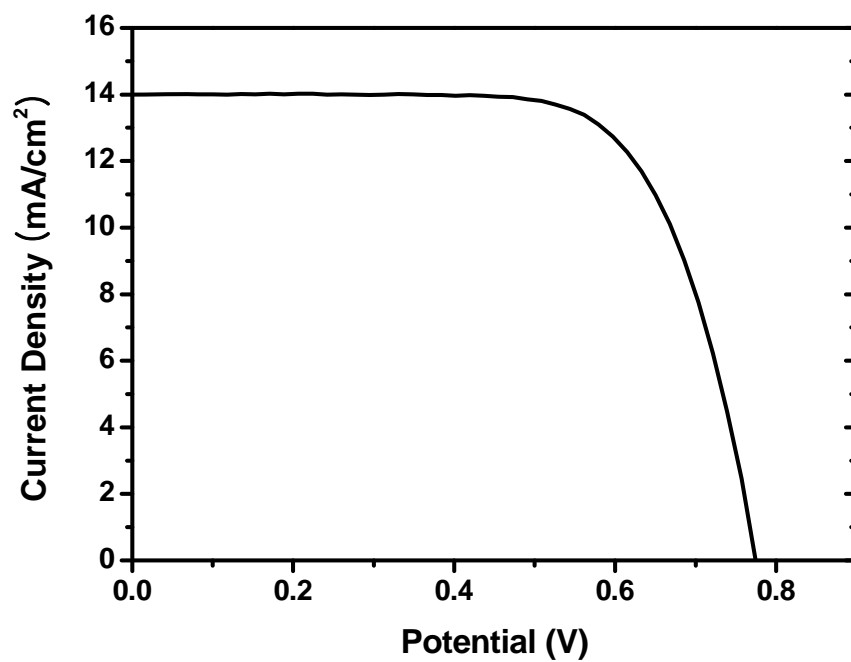


Fig S2. J-V curve of FTO/Pt based counter electrode based DSSC.