SUPPORTING INFORMATION

Characterization of charge transport properties of 3D electrode for dye-sensitized solar cells

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Figure S1. Raman spectra of NP-TiO₂ and pIO-TiO₂ film. The NP-TIO₂ showed four Raman active modes of $E_g$, $B_{1g}$, $A_{1g}$, and $E_g$ which represent the anatase phase of TiO₂. The pIO-TiO₂ showed Raman modes of $B_g$ and $A_{1g}$ from the rutile phase and the $E_g$ mode from the anatase phase. Raman spectra were taken using a Horiba Jobin Yvon LabRAM HR equipped with an air-cooled Ar-ion laser working at 541 nm.
Figure S2. XRD patterns of (a) pIO-TiO$_2$ films and (b) NP-TiO$_2$ structure. NP-TiO$_2$ electrodes shows anatase TiO$_2$ phase. In the case of pIO-TiO$_2$ electrodes, the majority of pIO-TiO$_2$ was present as a TiO$_2$ rutile phase. A relatively small anatase peak from the IO skeleton was also observed.
Figure S3. XPS Ti 2p spectrum of (a) the IO TiO$_2$ and (b) pIO TiO$_2$ structure; experimental data (circle), four deconvolved spectra (red solid line), summation of the four spectra (black solid line). The IO TiO$_2$ film was post-treated in 0.3 M TiCl$_4$ aqueous solution at 70°C for 30 min.
Figure S4. Normal transmittance spectra of pIO TiO$_2$ and NP TiO$_2$ film. The transmittance of pIO TiO$_2$ film was around 4 times lower than that of NP TiO$_2$ film over the measured range of wavelength, which implies the higher scattering property of pIO TiO$_2$ than NP TiO$_2$. The transmittance was measured using a UV-vis spectrophotometer (Shimadzu, UV-2550).