

Supporting Information for

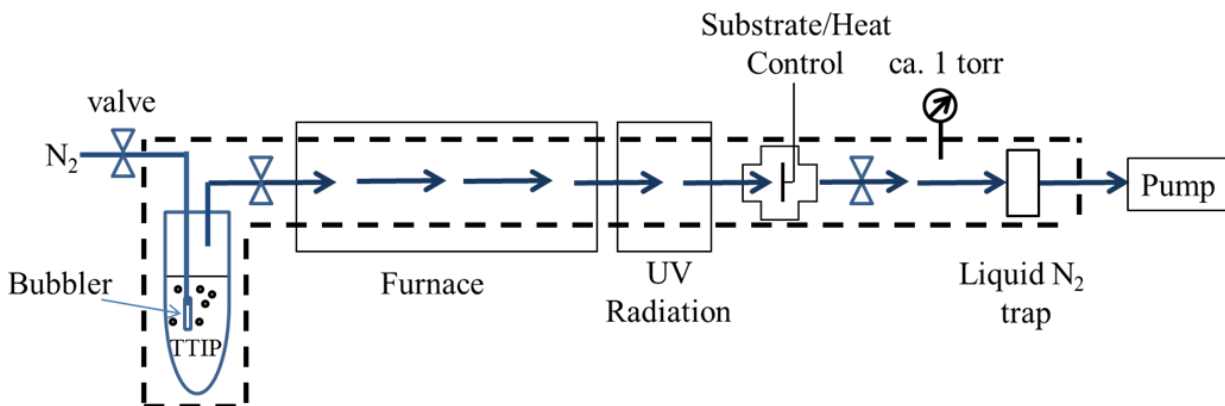
Titanium Dioxide Electron-Selective Interlayers  
Created by Chemical Vapor Deposition for Inverted  
Configuration Organic Solar Cells

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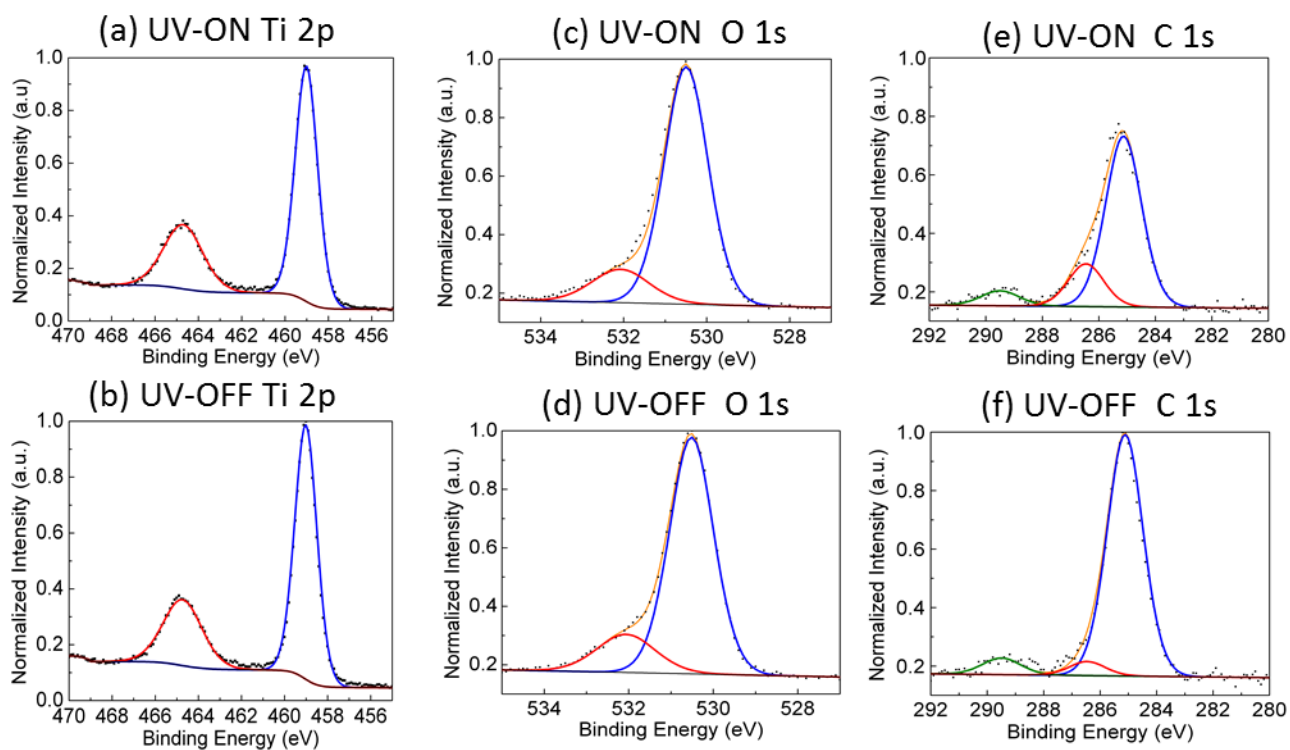
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Sample	BE(eV)	Ti 2p		O 1s		C 1s			Lattice O <sup>2-</sup> to Ti atomic ratio
		Ti 2p <sub>3/2</sub>	Ti 2p <sub>1/2</sub>	lattice O <sup>2-</sup>	-OH	C-C, C-H	C-O	C=O	
		459.0	464.7	530.5	532.1	285.1	286.5	289.5	
UV-OFF	Relative content (%)	20.2	39.5	8.4	28.4	1.5	1.9	1.96	
UV-ON		21.6	42.8	7.9	22.1	3.6	2.1	1.98	

**Table S1.** XPS summary of Ti 2p, O 1s C 1s peak fitting parameters, and area quantifications of UV-ON, UV-OFF TiO<sub>2</sub> samples grown at 210°C.

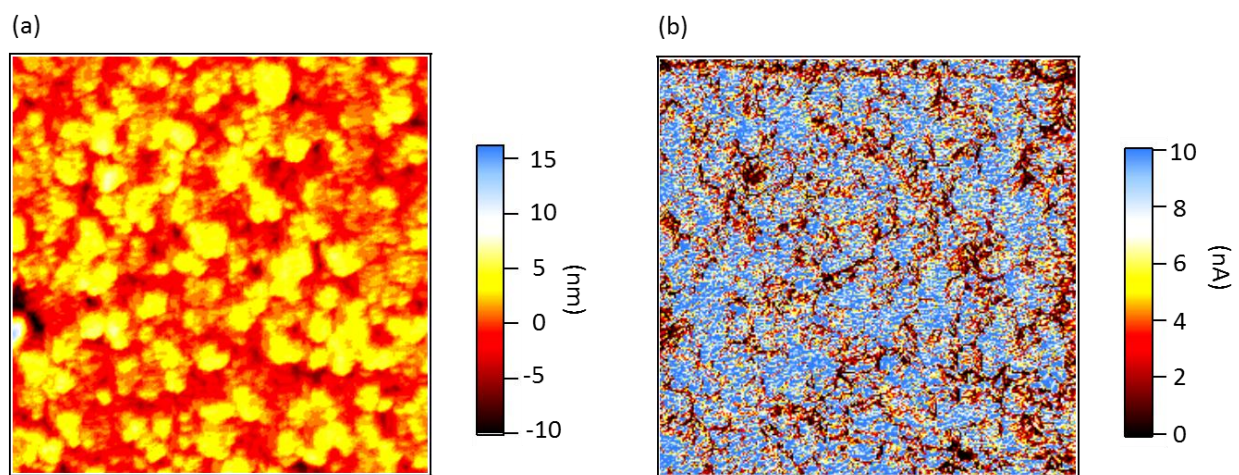


**Figure S1.** Schematic view of the CVD apparatus. TTIP is bubbled into a flowing stream of N<sub>2</sub>, to produce a mass flow rate of TTIP of ca. 0.67 sccm in a furnace held at ca. 180°C. UV-excitation from an array of 254 nm lamps immediately follows the furnace, the substrate is positioned just downstream from this UV exposure, at a distance of ca. 5 cm, with a substrate heater to provide for control of temperature from RT to 240°C.

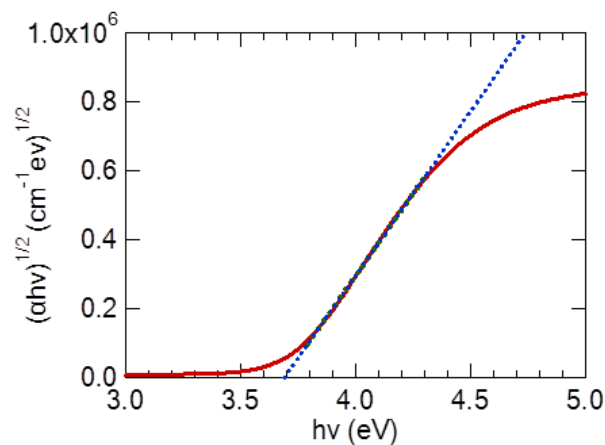


**Figure S2.** XPS Ti 2p spectra of CVD TiO<sub>2</sub> films grown at 210°C (a) with and (b) without UV illumination during deposition; O 1s spectra (c) with and (d) without UV illumination; C 1s spectra (e) with and (f) without UV illumination. The background, fitting components are included in the spectra. The spectrum intensity was normalized with the highest peak of each UV-OFF spectrum.

X-ray photoelectron spectroscopy (XPS) provides information about the chemical compositions of the deposited films. We aim to investigate the deposited film stoichiometric ratio and quantify the amount of remaining alkoxy ligands within the TiO<sub>2</sub> film. In this study, two films were used: with and without ultraviolet (UV-ON, UV-OFF) illumination during the deposition. (a) and (b) show the Ti 2p spectra of UV-ON and UV-OFF, respectively. Two narrow peaks: 459.0 eV was assigned to Ti 2p<sub>3/2</sub> and 464.7 eV to Ti 2p<sub>1/2</sub>. (c) and (d) show O 1s spectra of both samples. Two components: 530.5 eV was assigned to TiO<sub>2</sub> lattice O<sup>2-</sup> and 532.1 eV to other species (e.g. carbon oxygen bond, surface hydroxyl group). (e) and (f) show the C 1s spectra of both samples. Three components: (1) C-C, C-H at 285.1 eV (2) C-O at 286.5 eV, and (3) O-C=O at 289.5 eV were used to de-convolute the C 1s spectra.<sup>1</sup>



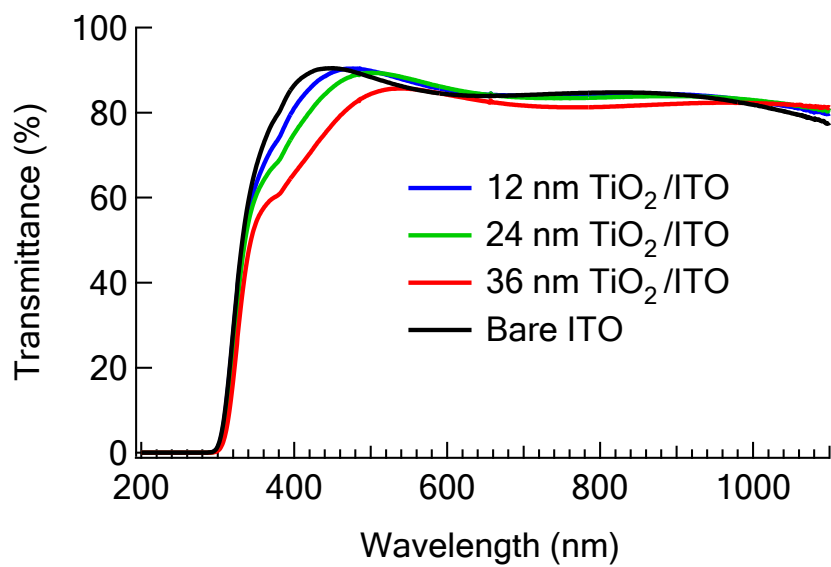
**Figure S3.** (a) Contact mode AFM image ( $2.5 \times 2.5 \mu\text{m}$ ) of ITO film. (b) shows the same area C-AFM current data using 0.2 V applied bias (tip vs. ITO).



**Figure S4.** Tauc plot of CVD TiO<sub>2</sub> on quartz

Figure S4 shows the Tauc plot of CVD TiO<sub>2</sub> on quartz. The optical band gap of CVD TiO<sub>2</sub> was estimated from the intercept at photon energy axis. 3.7 eV was obtained and used as the band gap of CVD TiO<sub>2</sub> material as shown in Figure 4 (f). The absorption coefficient ( $\alpha$ ) of TiO<sub>2</sub> film was calculated from equation (1), where  $t$  is film thickness;  $T$  is transmittance;  $R$  is reflectance. <sup>2</sup>

$$\alpha t = -\ln\left(\frac{T}{1-R}\right) \quad (1)$$



**Figure S5.** Transmittance data of various thicknesses CVD TiO<sub>2</sub> films on ITO substrates.

## REFERENCES

- (1) Vickerman, H. C. *Surface Analysis: The Principal Techniques*; John Wiley & Sons Ltd: Chichester, UK. , **1997**.
- (2) Srikant, V.; Clarke, D. R. *J. Appl. Phys.* **1998**, 83, 5447-5451.