

Supporting Information

The Effect of Light Environment during Film Formation Process on the Morphology and Function of Organic Photovoltaics

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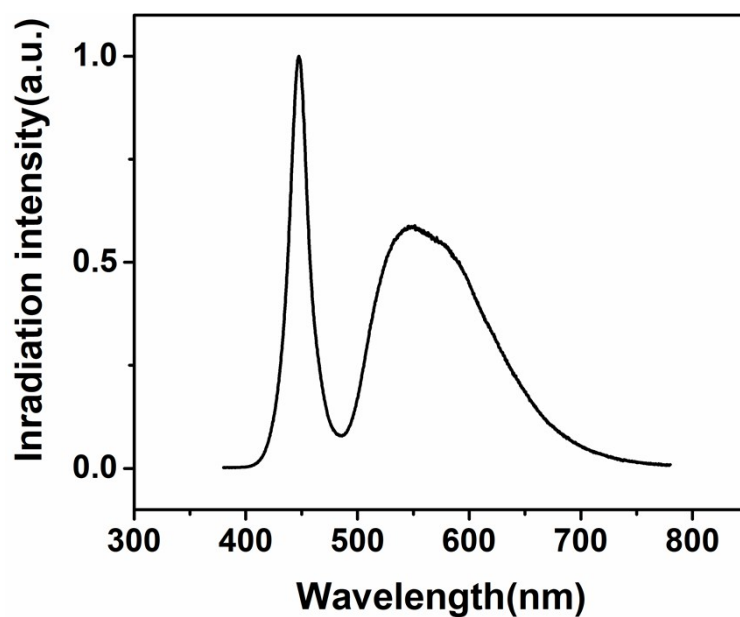


Fig. S1 The irradiation spectrum of the white LED.

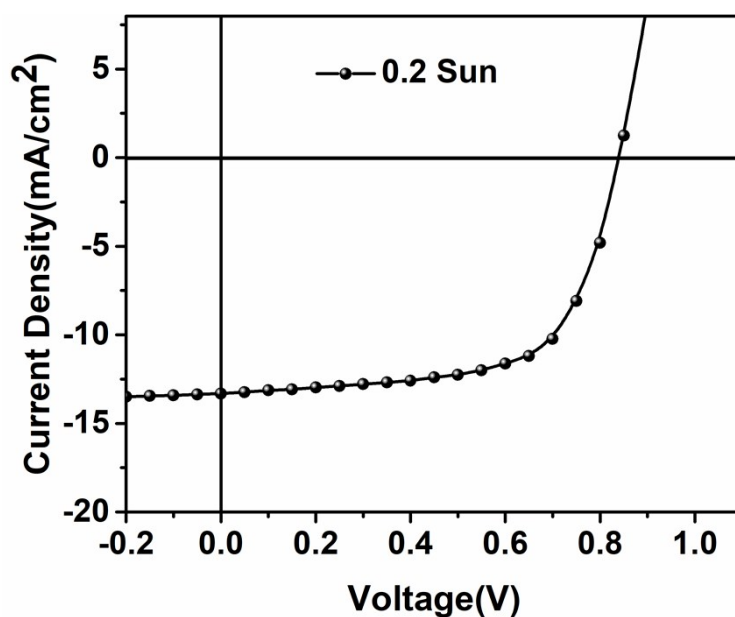


Fig. S2 J-V curves for p-DTS(FBTTH₂)₂:PCBM blends obtained under 0.2 Sun.

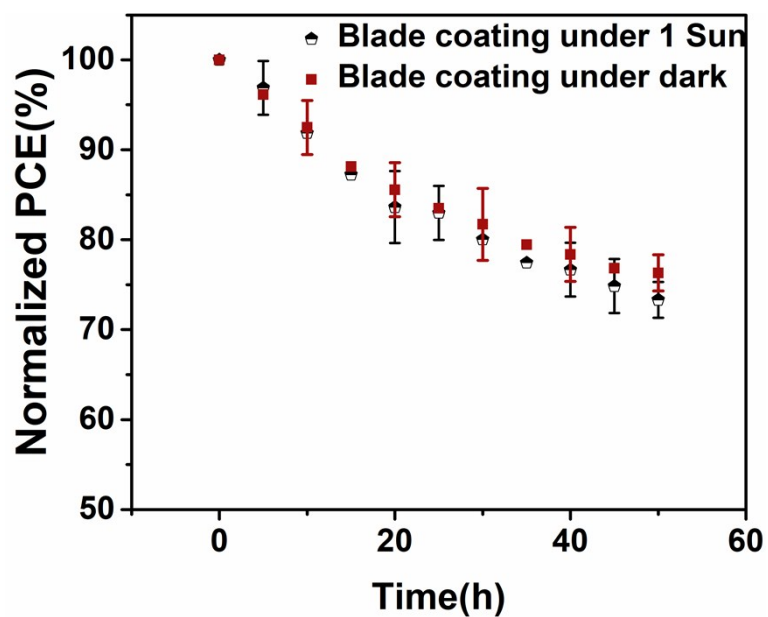


Fig. S3 Stability curves of p-DTS(FBTTH₂)₂:PCBM devices obtained with dark and 1 Sun under continuous AM 1.5G illumination for 50 h.

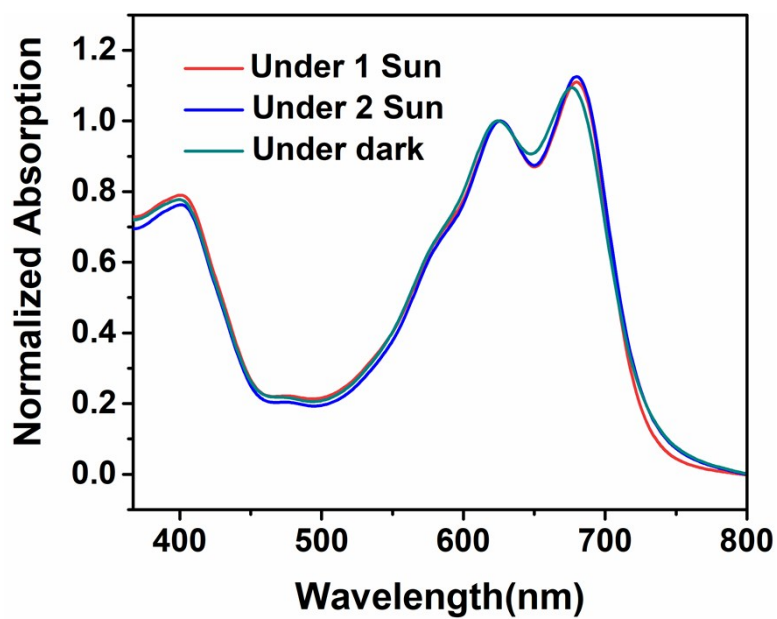


Fig. S4 Normalized UV-vis absorption spectra of p-DTS(FBTTH₂)₂:PCBM devices obtained from different light intensities.

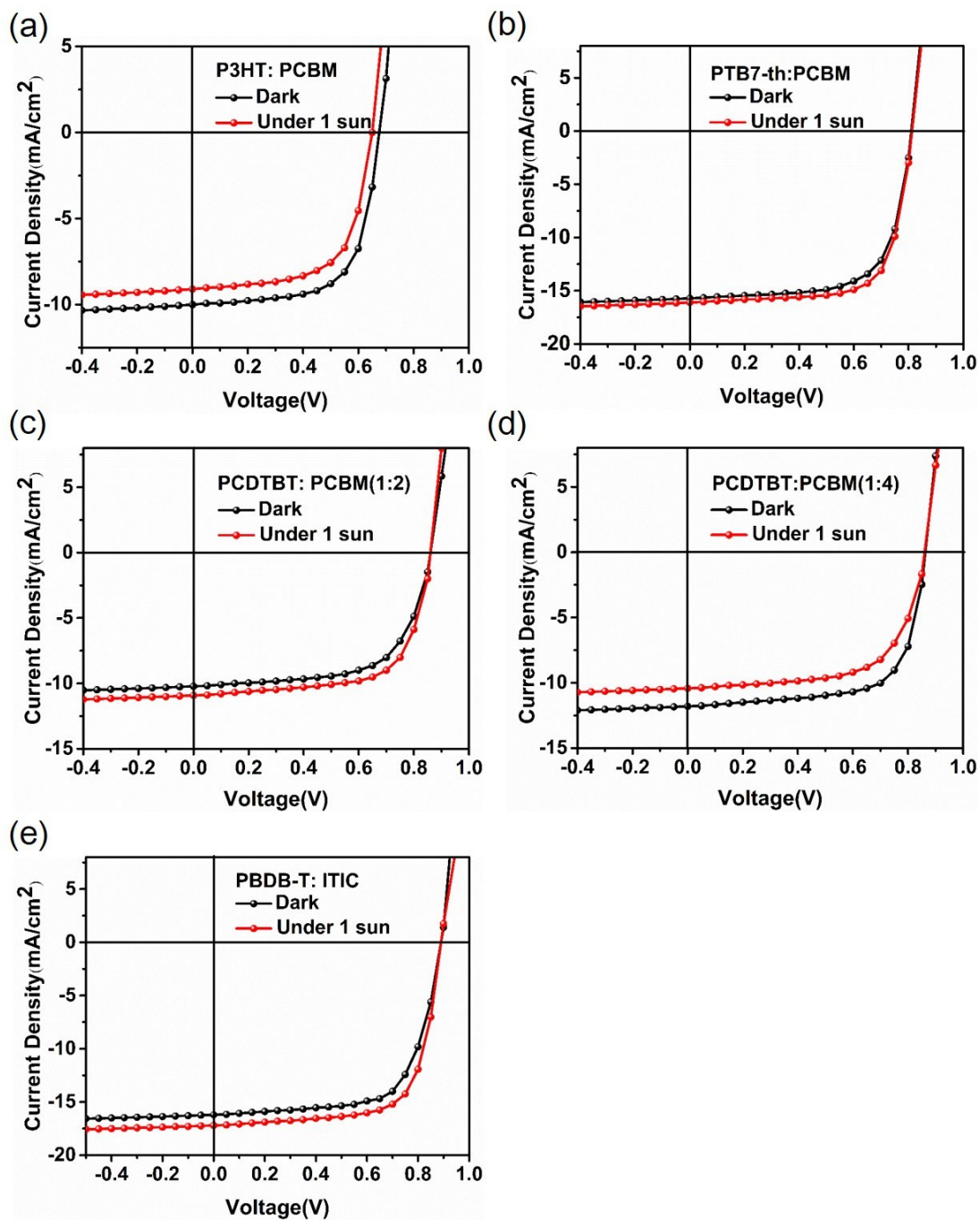


Fig. S5 J-V curves for (a) P3HT:PCBM; (b) PTB7-th:PCBM; (c) PCDTBT:PCBM (1:2); (d) PCDTBT:PCBM (1:4); (e) PBDB-T:ITIC blends.

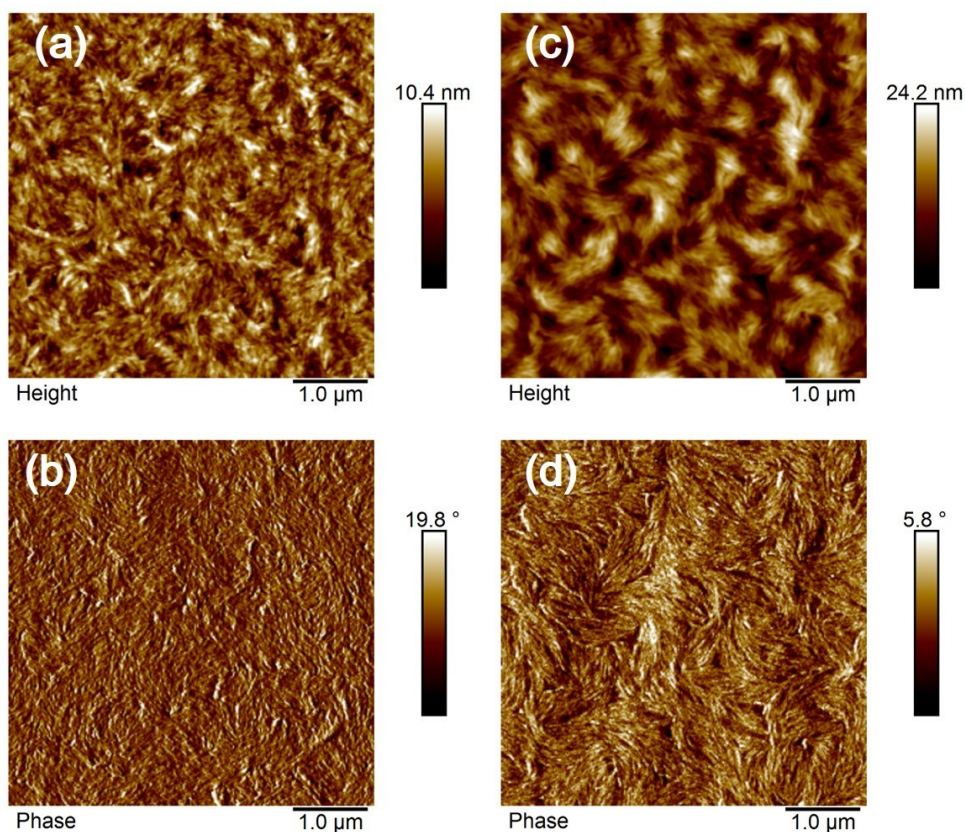


Fig. S6 AFM tapping mode height and phase image of the surfaces of PBDB-T:ITIC blends obtained under Dark (a, b), 1 Sun (c, d).

Table S1 Device performance of all samples at standard AM-1.5 illumination.

	Condition	J_{sc} (mA/cm ²)	V_{oc} (V)	FF (%)	PCE (%)
P3HT:PCBM	Dark	9.1± 0.3	0.65± 0.02	64.1± 0.2	3.8± 0.2
	1 Sun	10.0± 0.2	0.67± 0.04	66.3± 0.3	4.7± 0.3
PTB7-Th :PCBM	Dark	15.7± 0.3	0.81± 0.03	68.6± 0.3	8.7± 0.2
	1 Sun	16.1± 0.2	0.82± 0.04	69.5± 0.4	9.2± 0.3
PCDTBT:PCBM (1:2)	Dark	10.2± 0.4	0.86± 0.02	64.1± 0.2	5.6± 0.2
	1 Sun	10.9± 0.2	0.86± 0.02	66.0± 0.4	6.2± 0.2
PCDTBT:PCBM (1:4)	Dark	11.8± 0.3	0.87± 0.03	66.1± 0.2	6.8± 0.3
	1 Sun	10.4± 0.3	0.86± 0.04	63.8± 0.3	5.7± 0.3
PBDB-T:ITIC	Dark	16.2± 0.2	0.89± 0.03	68.2± 0.2	9.8± 0.2
	1 Sun	17.2± 0.2	0.89± 0.02	69.8± 0.4	10.7± 0.2

Device Fabrication

PTB7-Th, P3HT, PCDTBT, PBDB-T, PC₇₀BM were all purchased from 1-Material.

All active layers were blade-cast under the same substrate temperature and blade gap, which were performed under the dark and illumination with light intensity of 100 mW cm⁻² (1 sun), using a power-tunable white LED.

The devices of PTB7-Th:PC₇₀BM were fabricated with an inverted structure of ITO/ZnO /blends/ MoO₃/Ag. The ZnO precursor solution was prepared by dissolving 0.5 g of zinc acetate dehydrate (Zn(CH₃COO)₂·2H₂O, 99.9%, Alfa) and 138 ul of ethanolamine (NH₂CH₂CH₂OH, 99.5%, J&K) in 5 ml of 2-methoxyethanol (CH₃OCH₂CH₂OH, 99.8%, Alfa). The ZnO precursor was spin-coated at 4000 rpm for 1 min onto the ITO surface, followed by baking at 200 °C for 10 min in air. Solution of PTB7-Th:PC₇₀BM was prepared by dissolving PTB7-Th (4 mg/mL) and PC₇₀BM (6 mg/mL) in chlorobenzene with 3 vol% diiodooctane, and stirred overnight prior to blade-coating. The active layers were fabricated by blade coating at a constant speed of 6 mm/s. The substrate temperature was kept at 60 °C and the gap between the knife blade and substrate was 100 μm. The films were then baked at 100 °C for 5 mins in glove box to remove residual solvents. Subsequently, the double-layer structure of MoO₃ (8 nm)/Ag (90 nm) was deposited over the active layer by thermal evaporation under a vacuum chamber to accomplish the device fabrication.

The devices of P3HT:PCBM were fabricated with a structure of ITO/PEDOT:PSS/P3HT:PC₇₀BM/Al. For PEDOT:PSS-based devices, a thin layer of PEDOT:PSS was spin-coated with 4000 rpm for 20 seconds onto the cleaned ITO

substrate and then immediately annealed in air at 140 °C for 20 minutes, followed by blade-coating photoactive layer with controlled thickness of ≈ 100 nm. The solution for P3HT:PC₇₀BM was prepared by a 50:50 weight ratio blend dissolved in chloroform at a concentration of 17 mg/mL, and stirred all night. Finally, Al (90nm) electrode was deposited on the active layer through a shadow mask by thermal evaporation.

For the devices of ITO/PEDOT:PSS/PCDTBT:PCBM/Ca/Al, the PEDOT:PSS layer was fabricated as described before, and the PCDTBT:PCBM has two mixing ratios. PCDTBT and PC₇₀BM were dissolved in dichlorobenzene at a ratio of 1:2 by weight with a PCDTBT concentration of 4mg/ml, and then stirred all night prior to blade-cast with a constant speed of 5 mm/s. And then the samples were thermally annealed by being heated to 85 ° C for 1 hour under dry nitrogen. Another solution containing a mixture of PCDTBT:PC₇₀BM (1:4) in dichlorobenzene solvent with a concentration of 7 mg/ml was then blade-cast on top of the PEDOT:PSS layer with a constant speed of 10 mm/s. Finally, the double-layer structure of Ca (5 nm)/Al (90 nm) was deposited over the active layer by thermal evaporation after thermally annealed as before.

The devices of PBDB-T:ITIC were fabricated with a structure of ITO/ZnO/ PBDB-T:ITIC /MoO₃/Ag. The materials of PBDB-T:ITIC(1:1,w/w) were dissolved in CB (chlorobenzene:DIO 99.5:0.5 volume ratio) with total concentration of 20 mg/mL, and stirred all night. The active layers were fabricated by blade coating at a constant speed of 5 mm/s and then annealed at 150 °C for 10 min blends film in a nitrogen-filled glove box. Other fabrication processes were prepared as described above.