Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information for

Improving performance of organic solar cells by supplying additional acceptors to surface of bulk-heterojunction layers

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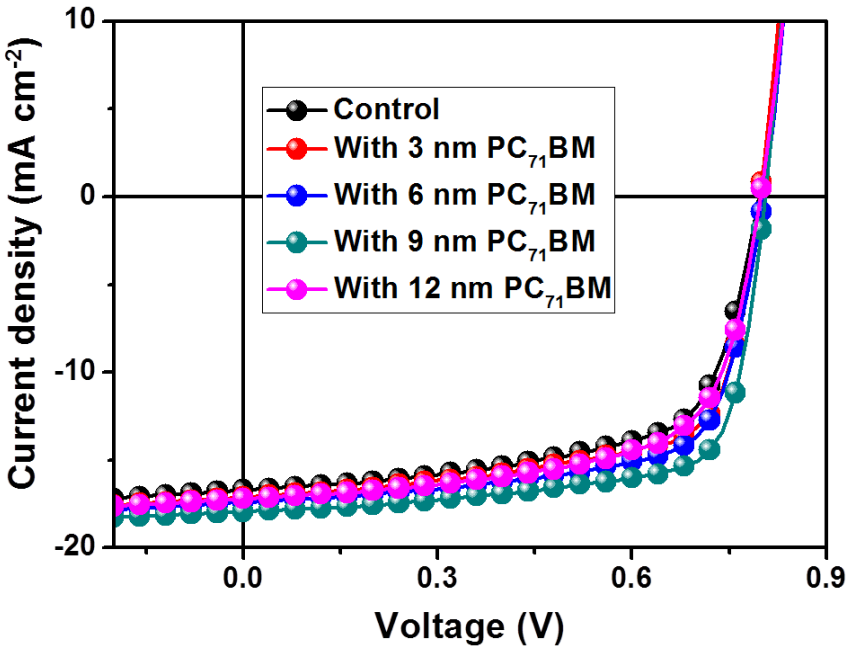

Fig. S1. *J*–*V* characteristics for the OSCs without (control) and with 3, 6, 9, and 12 nm additional $PC_{71}BM$ layer.

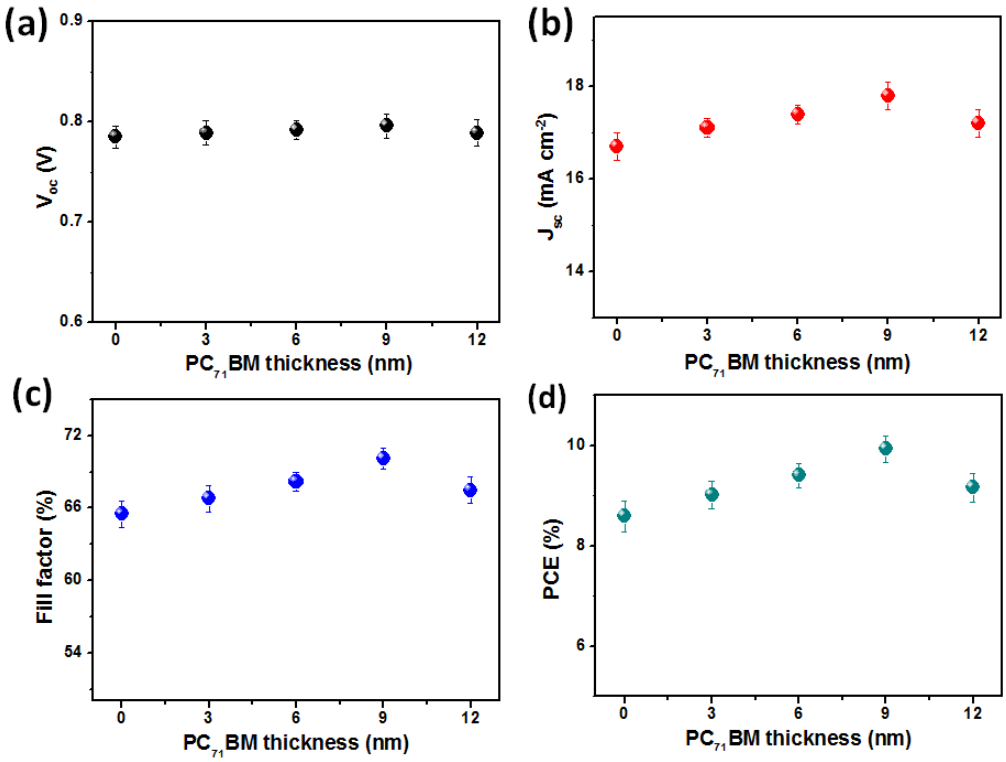

Fig. S2. Average values and standard deviations of (a) V_{oc}, (b) J_{sc}, (c) FF, and (d) PCE of 12 individual OSCs.

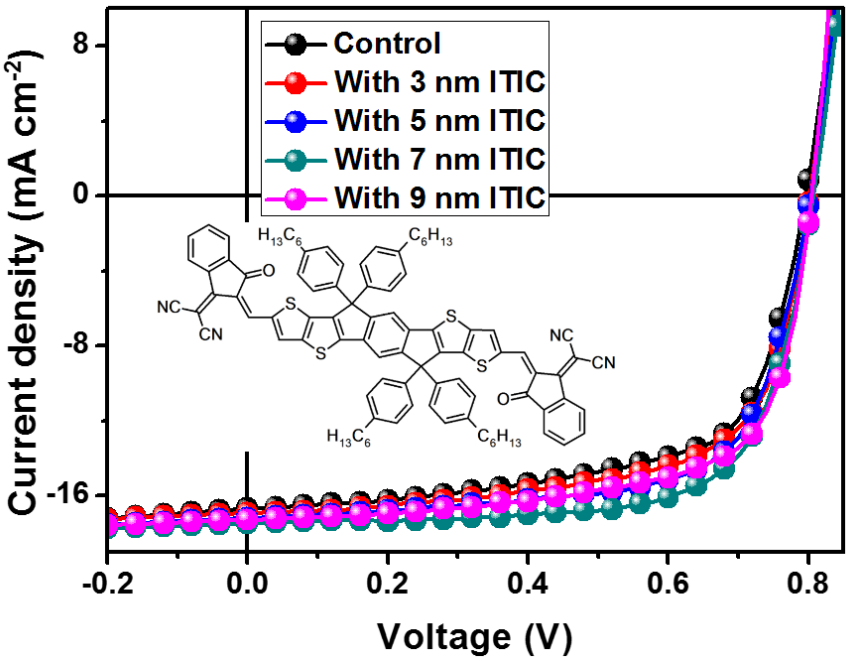

Fig. S3. *J*–*V* characteristics for the OSCs without (control) and with 3, 5, 7, and 9 nm additional ITIC layer. The inset of the figure shows the molecular structure of ITIC.

Electron mobility measurement

The electron mobility was measured following the space-charge limited current approach. The electron-only device was fabrication using the following architecture ITO/ZnO/PTB7-Th:$PC_{71}BM$/$PC_{71}BM$/Al. For the control device, the use of additional $PC_{71}BM$ was skipped. We used a solution-processing method for preparing ZnO following previous work.[1] The *J*–*V* characteristics for electron-only devices were measured in the dark. The mobility was calculated from the *J*–*V* characteristics following Mott–Gurney law:

$$J = \frac{9\varepsilon_0\varepsilon_r\mu(V - V_{bi})^2}{8L^3} \quad (1)$$

where J is the current density, ε_0 is the permittivity of free space, ε_r is the relative dielectric constant of the organic active layer, V is the applied voltage, V_{bi} is the built-in voltage, μ is the electron mobility, and L is the thickness of the active layer.

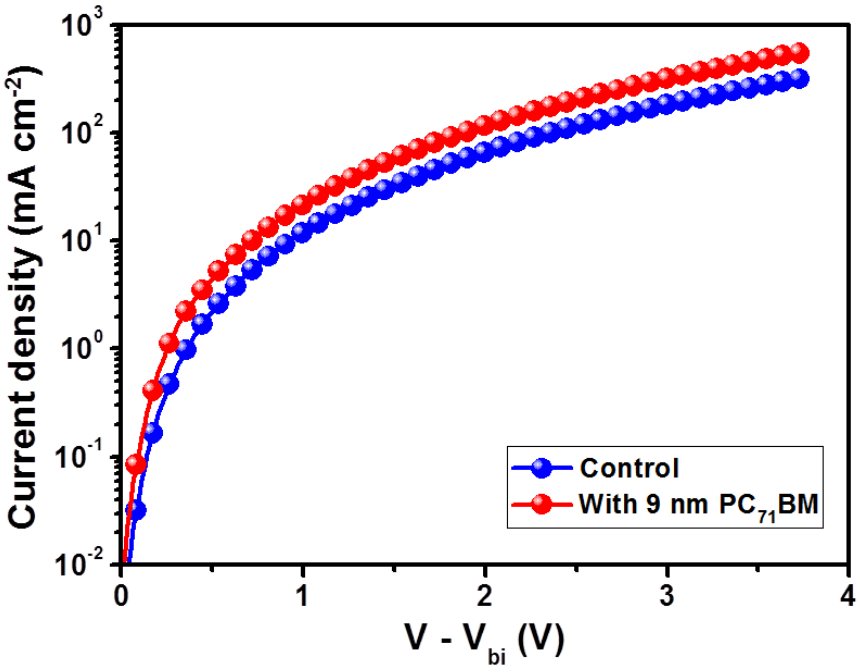

Fig. S4. *J–V* characteristics for the electron-only device without and with 9 nm additional $PC_{71}BM$.

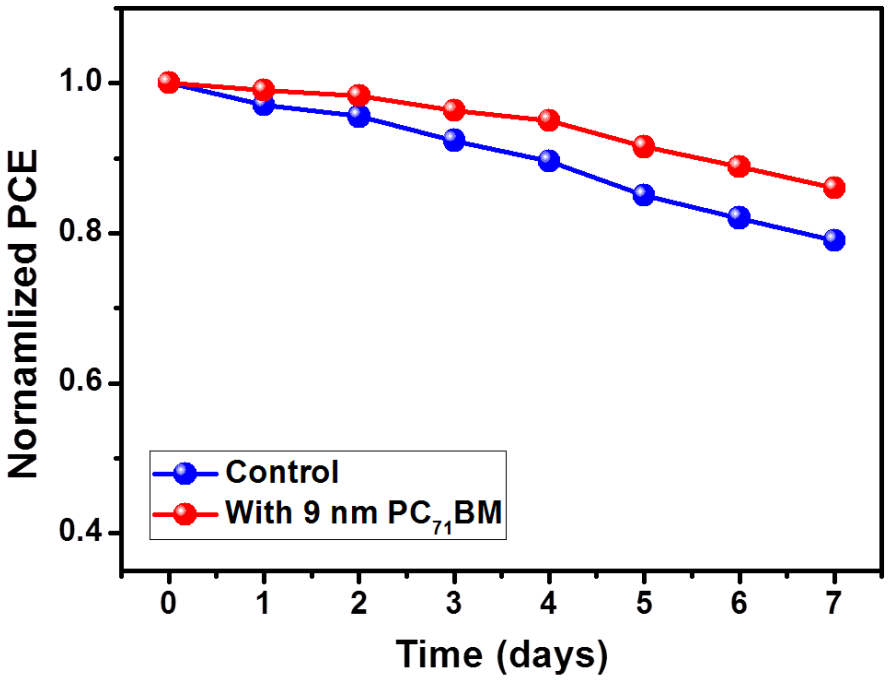

Fig. S5. Stability of the OSCs without and with 9 nm additional $PC_{71}BM$, in terms of the normalized PCEs, plotted *vs.* time.

Table S1. Device parameters (average and best values for 12 individual devices in each group) for rigid OSCs based on 0, 3, 5, 7, or 9 nm additional ITIC layer.

Device configuration (rigid)	V_{oc} (V)	J_{sc} (mA cm^{-2})	FF (%)	Average PCE (%)	Best PCE (%)
Without ITIC layer (control)	0.785 ± 0.011	16.7 ± 0.3	65.5 ± 1.1	8.59 ± 0.31	8.99
With 3 nm ITIC layer	0.787 ± 0.010	16.9 ± 0.3	66.1 ± 1.1	8.79 ± 0.32	9.05
With 5 nm ITIC layer	0.788 ± 0.011	17.2 ± 0.3	67.2 ± 0.8	9.11 ± 0.28	9.42
With 7 nm ITIC layer	0.792 ± 0.011	17.5 ± 0.3	68.3 ± 0.9	9.47 ± 0.29	9.78
With 9 nm ITIC layer	0.789 ± 0.012	17.3 ± 0.2	67.5 ± 1.1	9.21 ± 0.30	9.53

Reference

1 Y. Sun, J. H. Seo, C. J. Takacs, J. Seifter, and A. J. Heeger, *Adv. Mater.* 2011, **23,** 1679–1683.