Electronic Supplementary Material (ESI) for Polymer Chemistry.

Supporting Information

Diindenocarbazole-based large bandgap copolymers for high-performance organic solar cells with large open circuit voltages

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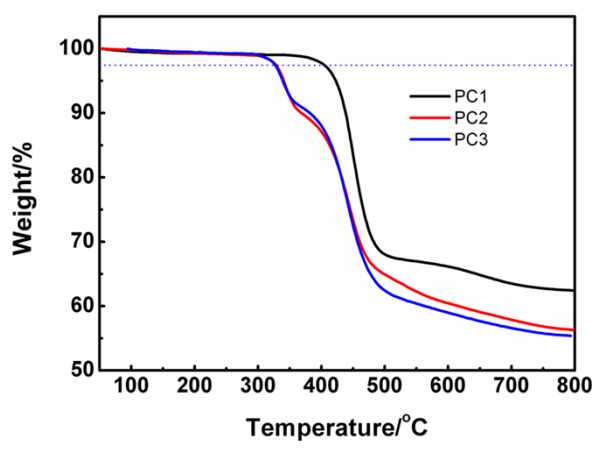

Figure S1. TGA plots of the polymers with a heating rate of 10 °C/min under an inert atmosphere.

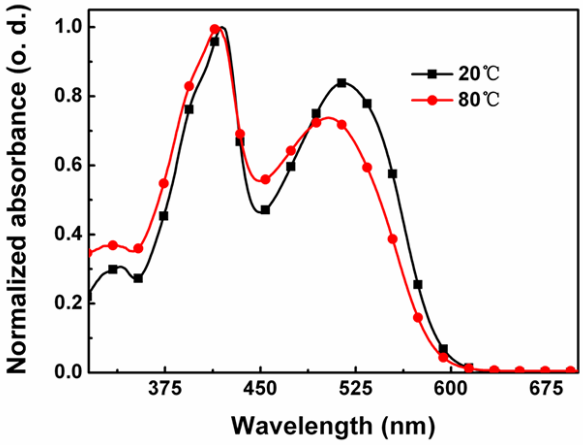

Figure S2. UV-vis spectra of PC2 in chlorobenzene solution (1×10^{-5} M) measured at 20 °C and at 80 °C, respectively.

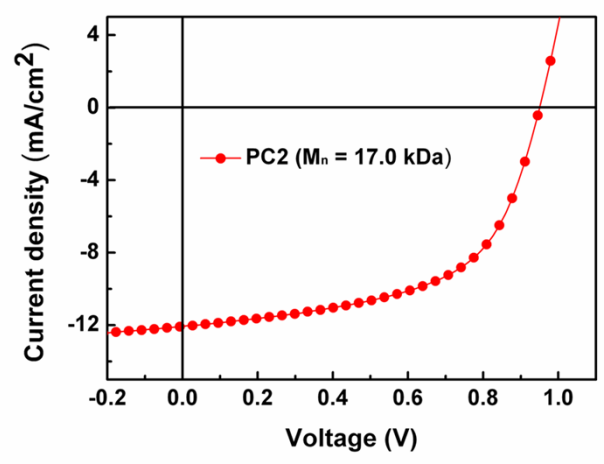

Figure S3. Current density-voltage (*J-V*) curve of the optimized conventional PSC based on PC2 (low molecular weight) blended with $PC_{71}BM$ (1:4, w/w), under AM 1.5G illumination (100 mW/cm^2).

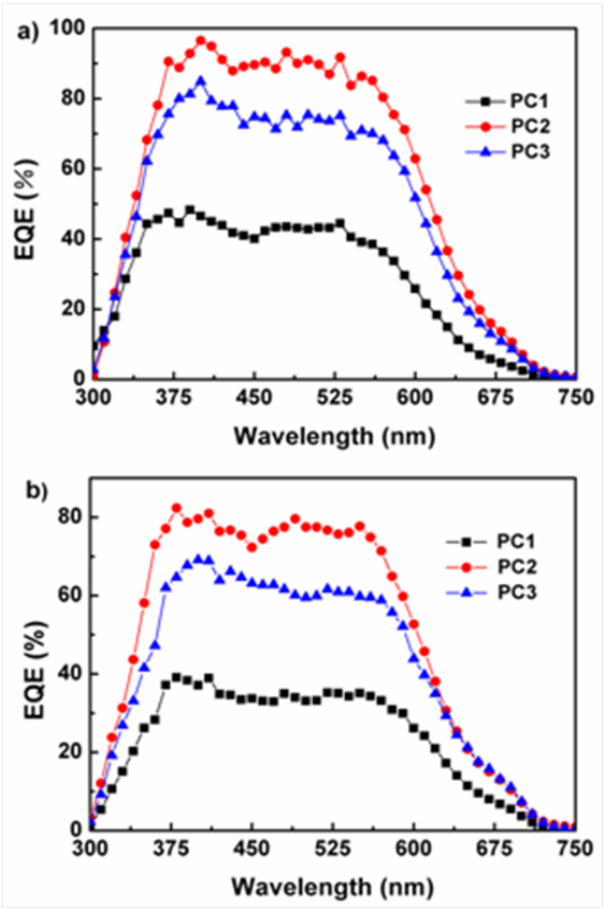

Figure S4. EQE curves of the conventional PSCs (a) and the inverted PSCs (b) based on PCx:$PC_{71}BM$ with 0.5% (v/v) DIO as additive.

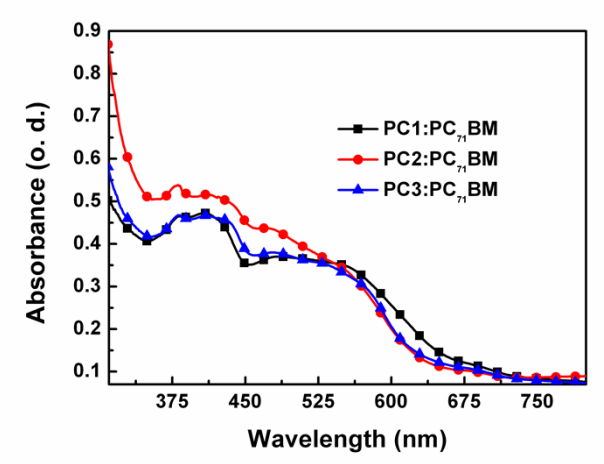

Figure S5. Normalized UV-vis absorption spectra of the polymer:$PC_{71}BM$ blend films spin-coated under the same conditions as the fabrication of the optimized PSCs.

Table S1 Photovoltaic performance of the optimized inverted PSCs, under the illumination of AM 1.5G, 100 mW/cm^2

Polymer[a]	D:A[b]	V_{oc} [V]	J_{sc} [mA cm^{-2}]	*FF* [%]	PCE[c] [%]
PC1	1:4	0.75 ± 0.04	5.13 ± 0.33	45.3 ± 2.9	1.73 ± 0.16 (1.84)
PC2	1:4	0.92 ± 0.02	10.85 ± 0.25	59.3 ± 1.3	5.91 ± 0.26 (6.17)
PC3	1:4	0.94 ± 0.01	9.17 ± 0.31	61.5 ± 4.7	5.28 ± 0.47 (5.75)

[a] A mixed solvent of *o*-DCB:CB (1:4, v/v) containing 0.5% (v/v) DIO is used. [b] Blend ratio of polymer: $PC_{71}BM$. [c] The data have been averaged over 8 devices of different batches. The performance of the best device is given in parentheses.

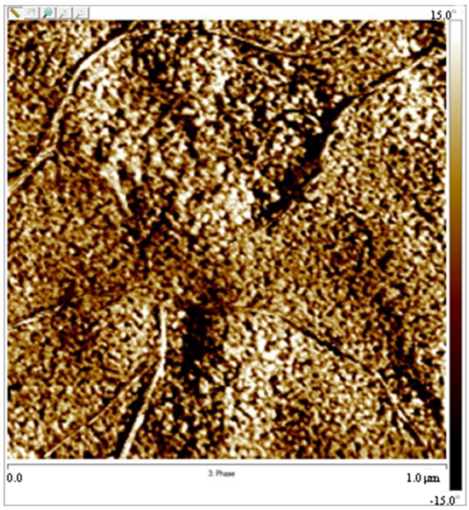

Figure S6. Tapping-mode AFM phase image of the blend film of PC1:$PC_{71}BM$ processed with 0.5% (v/v) DIO. The scan size is 1.0 µm × 1.0 µm.

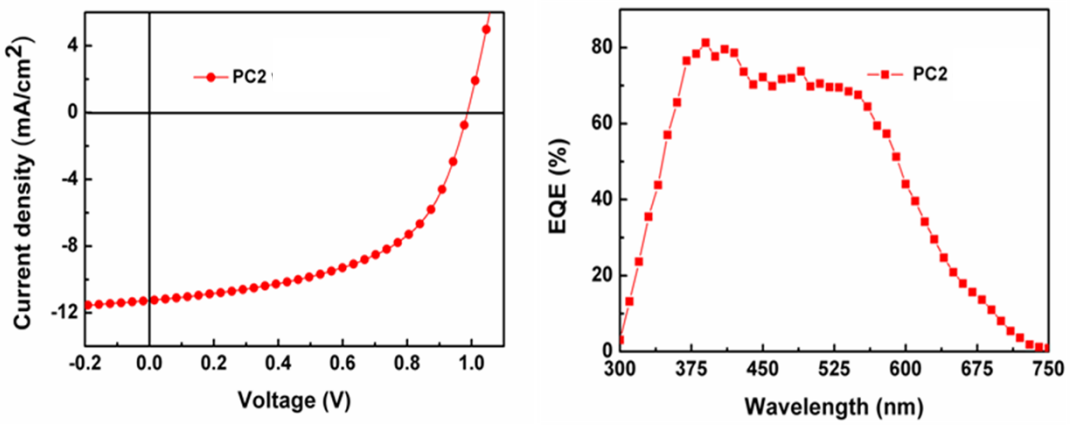

Figure S7. Current density-voltage (*J-V*) curve (left) and EQE spectrum (right) of the polymer solar cell based on PC2:$PC_{71}BM$ (1:4, w/w) without DIO treatment, under the illumination of AM 1.5G, 100 mW/cm^2.

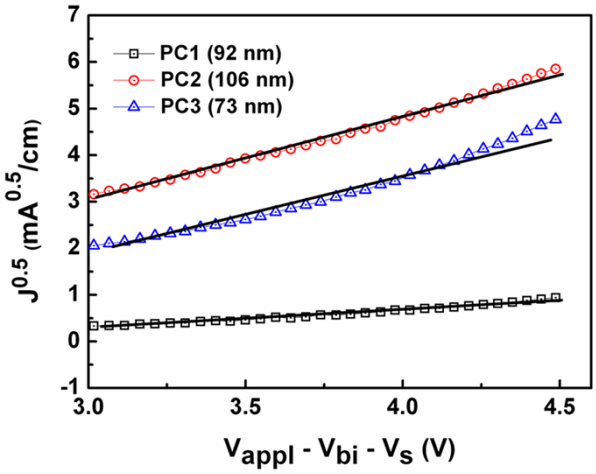

Figure S8. $J^{1/2}$-*V* characteristics of PC1, PC2, and PC3 based hole-only devices measured at the ambient temperature.

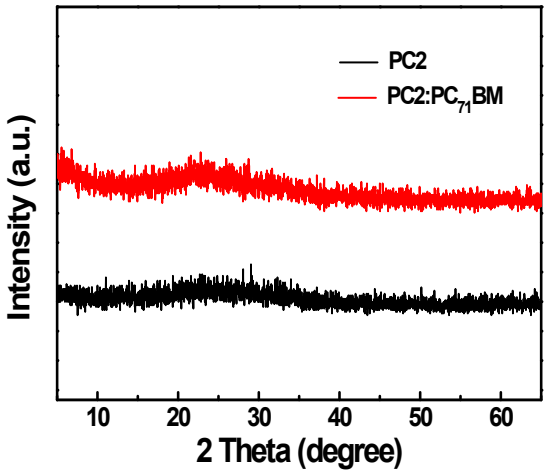

Figure S9. X-ray diffraction pattern of PC2 and PC2:$PC_{71}BM$ film.