Electronic Supplementary Material (ESI) for Polymer Chemistry.

A Novel Donor-Acceptor Alternating Copolymer Based on Angular-shaped Benzo[2,1-b:3,4-b']diselenophene for Bulk Heterojunction Solar Cells

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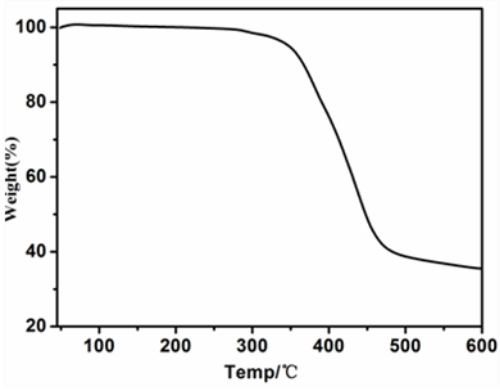

Figure S1. TGA curve of **PBDSe-DTBT** at a heating rate of 10 ºC min^{-1} under nitrogen flow.

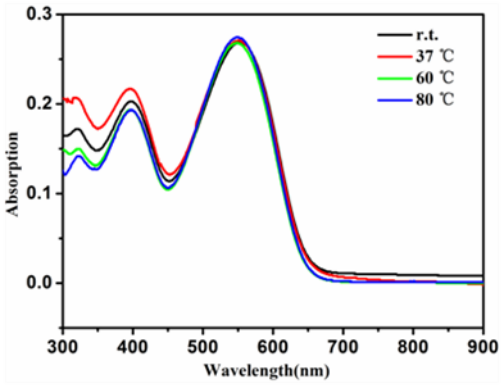

Figure S2. Absorption spectra of **PBDSe-DTBT** in *o*-DCB solutions at different temperature.

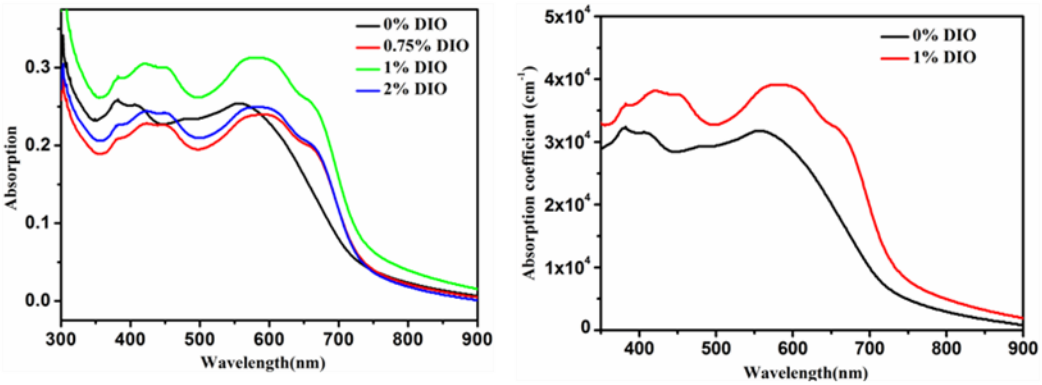

Figure S3. Absorption spectra of **PBDSe-DTBT**: $PC_{71}BM$ blend films with different amounts of DIO (left), and absorption coefficients of blend films without DIO and with 1% DIO under optimized device conditions.

Table S1 Photovoltaic properties of the various ratio of **PBDSe-DTBT**:$PC_{71}BM$ BHJs at different blend film thickness with different amounts of DIO additive.

PBDSe-DTBT :$PC_{71}BM$ (weight ratio)	DIO (% v/v)	*d* (nm)	V_{oc} (V)	J_{sc} (mA cm^{-2})	*FF*	PCE (%)
1:0.8	0	90	0.75 ± 0.02	7.78 ± 0.26	0.33 ± 0.01	1.9 ± 0.1
1:1	0	80	0.82 ± 0.01	8.90 ± 0.45	0.37 ± 0.01	2.7 ± 0.1
1:1.5	0	75	0.77 ± 0.02	8.02 ± 0.66	0.36 ± 0.01	2.2 ± 0.2
1:2	0	77	0.82 ± 0.01	8.12 ± 0.53	0.33 ± 0.01	2.2 ± 0.1
	0.75	70	0.80 ± 0.01	8.44 ± 0.43	0.52 ± 0.01	3.5 ± 0.2
	1	74	0.80 ± 0.01	12.30 ± 0.35	0.57 ± 0.01	5.6 ± 0.2
1:1	1.25	76	0.80 ± 0.01	11.38 ± 0.71	0.56 ± 0.01	5.1 ± 0.3
	1.5	74	0.78 ± 0.01	10.66 ± 0.69	0.56 ± 0.01	4.7 ± 0.3
	2	78	0.78 ± 0.01	10.93 ± 0.39	0.56 ± 0.01	4.8 ± 0.1

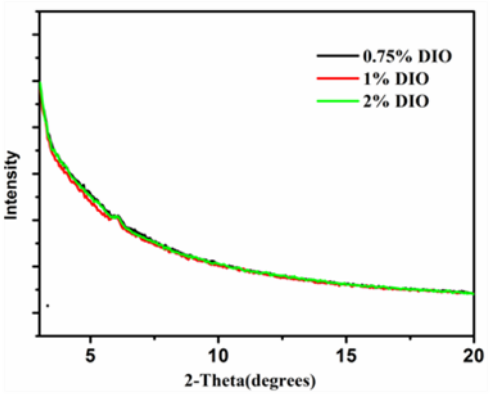

Figure S4. Out-of-plane X-ray profile spectra of pristine **PBDSe-DTBT** and BHJ blend films.

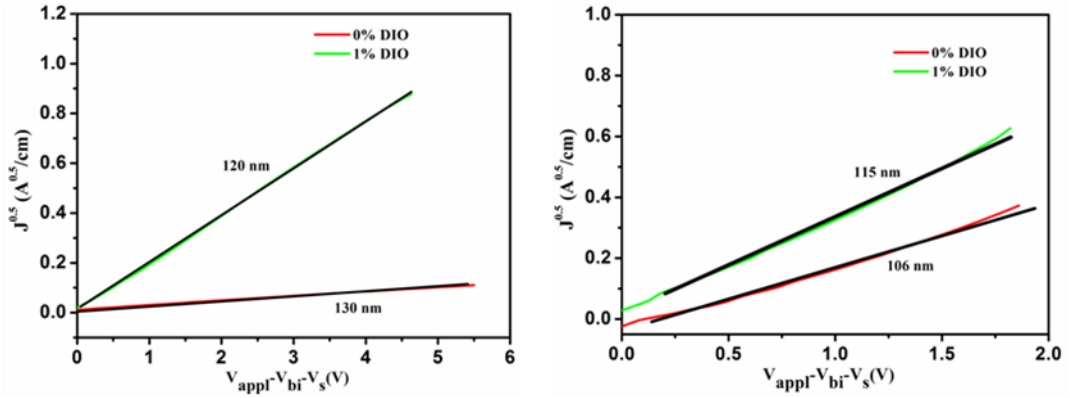

Figure S5. $J^{0.5}$ vs V_{appl} plots for hole only devices of ITO/PEDOT: PSS (40 nm)/polymers: $PC_{71}BM$ /Pd(50 nm) (left) and electron only devices of glass/Al(80 nm)/**PBDSe-DTBT**: $PC_{71}BM$/ Ca(20 nm)/Al(80 nm)

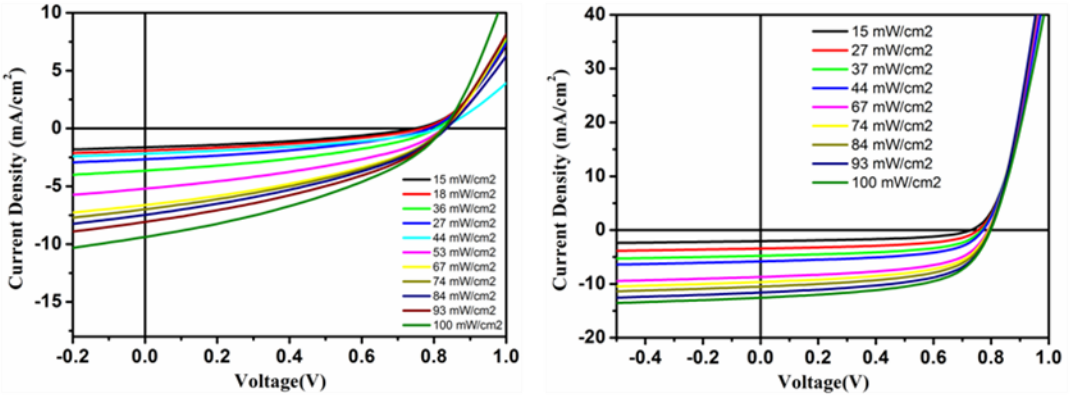

Figure S6. J-V characteristics of **PBDSe-DTBT**: $PC_{71}BM$ solar cells with 0% DIO (left) and 1% DIO (right) under various light intensities.