Supporting Information

Toward Reliable and Accurate Evaluation of Polymer Solar Cells Based on Low Band Gap Polymers

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S1. Device fabrication details

The PSCs were prepared on glass substrates with tin-doped indium oxide (ITO, 15 Ω/sq) patterned on the surface. We cleaned ITO substrates in sequential ultrasonic baths using detergent, water, acetone, and 2-propanol, followed by 15 min UV-ozone treatment. Then, an aqueous solution of PEDOT:PSS (Clevios P VP AI 4083) was spin-cast at 4000 rpm onto the substrates for ~35 nm thin film and baked at 150 ℃ for 15 min. Immediately after baking the substrates, the samples were then transferred into a dry nitrogen glovebox (<5 ppm O_2) for active layer deposition. The polymer/$PC_{71}BM$ blend solutions were stirred for 6 hours. The solution details of active layers are listed in the **Table S1**. For instance, PBDTTT-C-T and $PC_{71}BM$ at a 1:1.5 weight ratio in a 10 mg/ml *o*-dichlorobenzene (DCB) solution was spin-coated at 800 rpm for 90 s, and 3% vol 1,8-diiodooctane (DIO) was added into the blend solution for morphology modulation. PSBTBT and $PC_{71}BM$ at a 1:1 weight ratio in a 10 mg/ml chlorobenzene (CB) solution was spin-coated at 1000 rpm for 60 s， and then the active layer was subsequently annealed at 140 ^oC for 5 min. Prior to evaporating metal cathodes, the blend films with processing additives were treated with 60 uL methanol to remove the residual DIO.[1] The device fabrication was completed by thermal evaporation of a 20 nm thick Ca

and a 80 nm thick Al layer as cathode under vacuum at a base pressure of 2×10^{-4} Pa. Following electrode deposition, samples underwent *J-V* testing.

Table S1. The fabrication details of PSCs based on various photovoltaic polymers.

Polymer	Concentration of Polymer [mg/ml]	D/A ratio	Solvent	Thickness [nm]	*Ref.*
PBDTTT-C-T:$PC_{71}BM$	10	1:1.5	DCB/DIO (97/3)	95 nm	[1]
P3HT:$PC_{71}BM$	17	1:1	DCB	180 nm	[2]
PTB7-Th:$PC_{71}BM$	10	1:1.5	DCB/DIO (97/3)	100 nm	[3]
PBDTBDD:$PC_{71}BM$	10	1:1	DCB/DIO (97/3)	85 nm	[4]
PBTTDPP-T:$PC_{71}BM$	6	1:2	CB/DIO (99.5/0.5)	100 nm	[5]
PDPP3T:$PC_{71}BM$	5	1:2	DCB/CF/DIO (76/19/5)	110 nm	[6]
PBDTTPD:$PC_{71}BM$	20	1:1	CF/DIO (97/3)	105 nm	[7]
PBDD4T:$PC_{71}BM$	10	1.5:1	DCB/DIO (97/3)	75 nm	[8]
PSBTBT:$PC_{71}BM$	10	1:1	CB	80 nm	[9]

S2. Absorption spectrum of different photovoltaic polymers

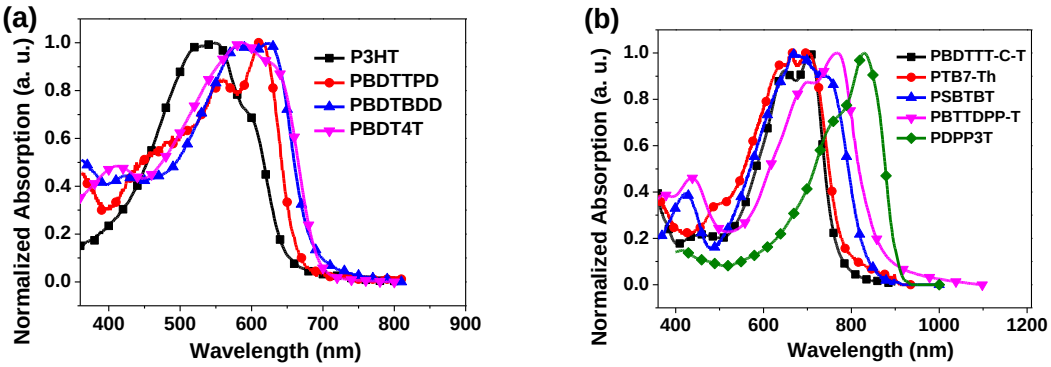

Fig. **S1**. Absorption spectrum of different photovoltaic polymers: (a) P3HT, PBDTTPD, PBDTBDD, and PBDD4T; (b) PTB7-Th, PBDTTT-C-T, PSBTBT, PDPP3T, and PBTTDPP-T.

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