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Supporting Information

Semi-crystalline random conjugated copolymers with panchromatic absorption for highly efficient polymer solar cells

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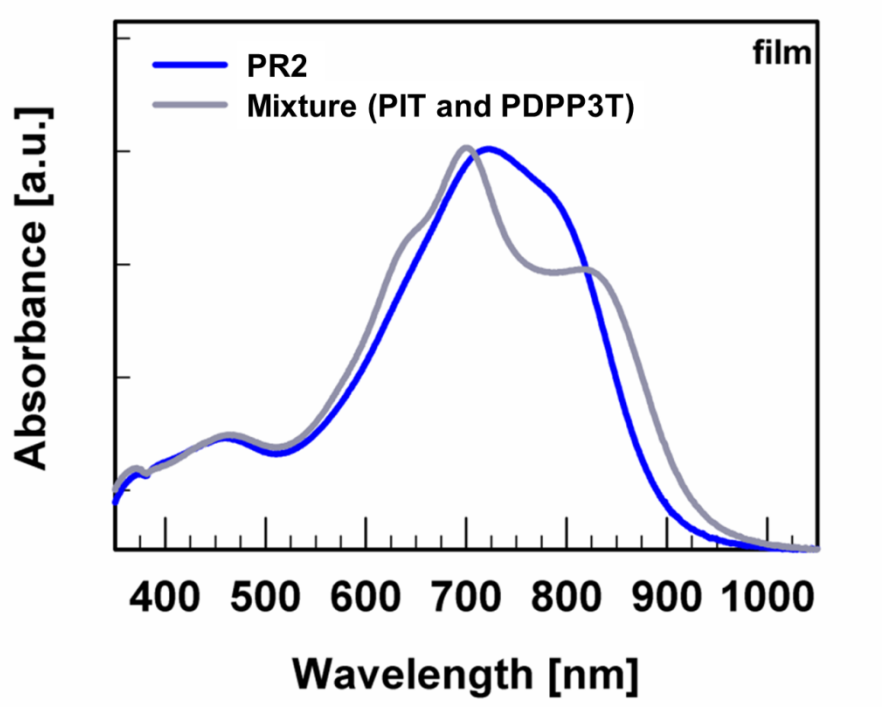

Fig. S1 UV-Vis absorption spectra of PR2 and a mixture of PIT and PDPP3T in film state.

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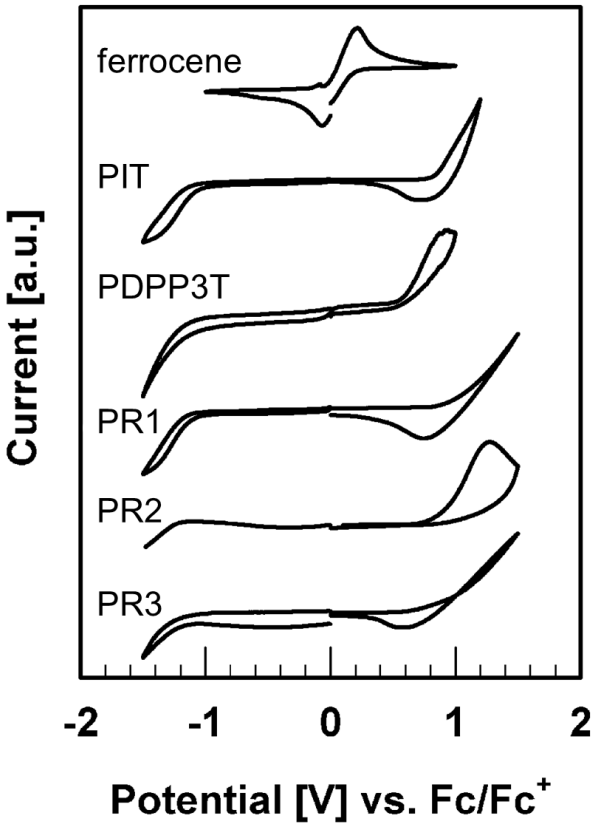

Fig. S2 Cyclic voltammetry curves of PIT, PDPP3T and random copolymers.

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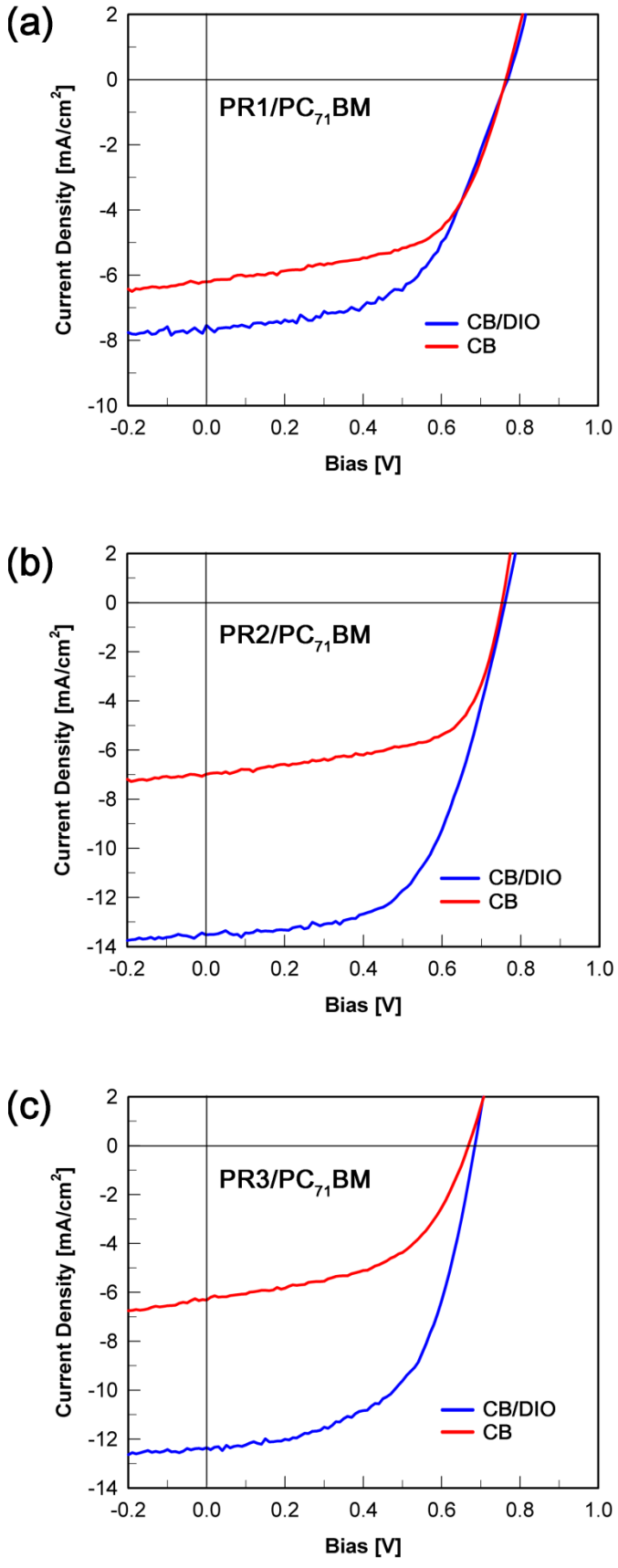

Fig. S3 J-V curves of PSCs of random copolymers fabricated under different conditions.

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Table S1 Photovoltaic properties of PSCs based on random copolymer and $PC_{71}BM$

active layer	solvent	V_{OC} (V)	J_{SC} (mA/cm^2)	FF	PCE_{Max} (%)	$PCE_{Average}$ (%)
PR1:$PC_{71}BM$	CB	0.77	6.20	0.58	2.77	2.68
	CB/DIO	0.78	7.84	0.57	3.49	3.30
PR2:$PC_{71}BM$	CB	0.76	6.99	0.61	3.24	3.11
	CB/DIO	0.77	13.52	0.58	6.04	5.88
PR3:$PC_{71}BM$	CB	0.67	6.32	0.51	2.16	2.12
	CB/DIO	0.69.	12.35	0.57	4.86	4.75

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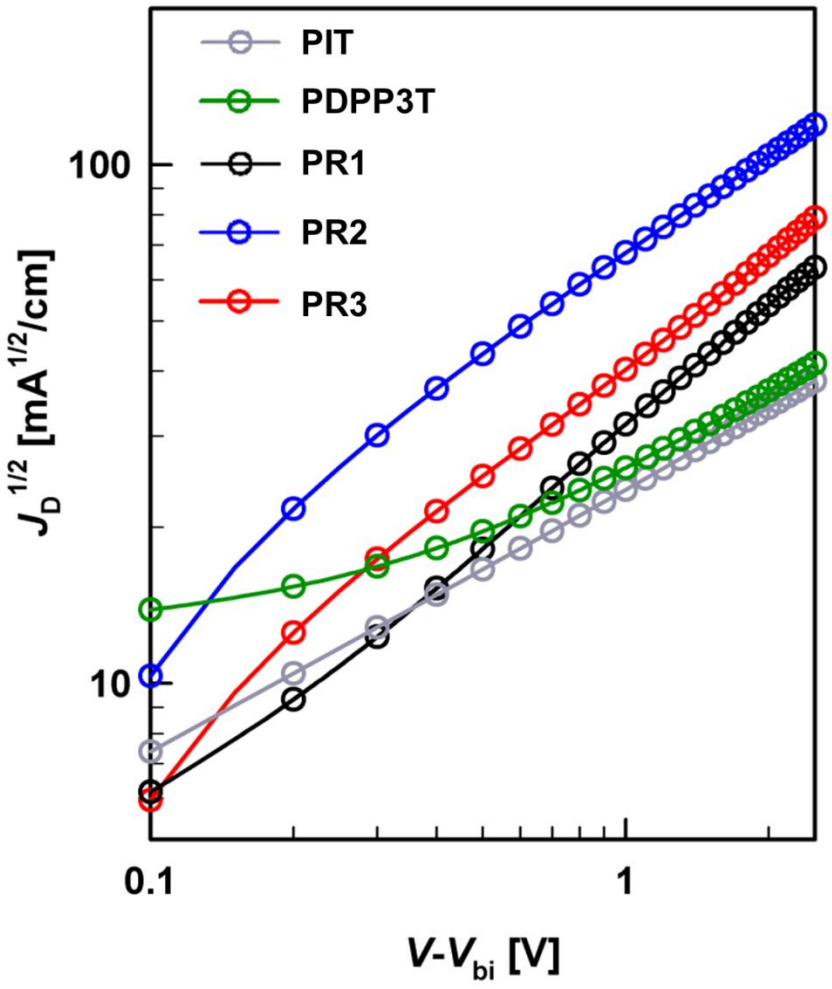

Fig. S4 SCLC hole mobilities of PIT, PDPP3T and random copolymers.

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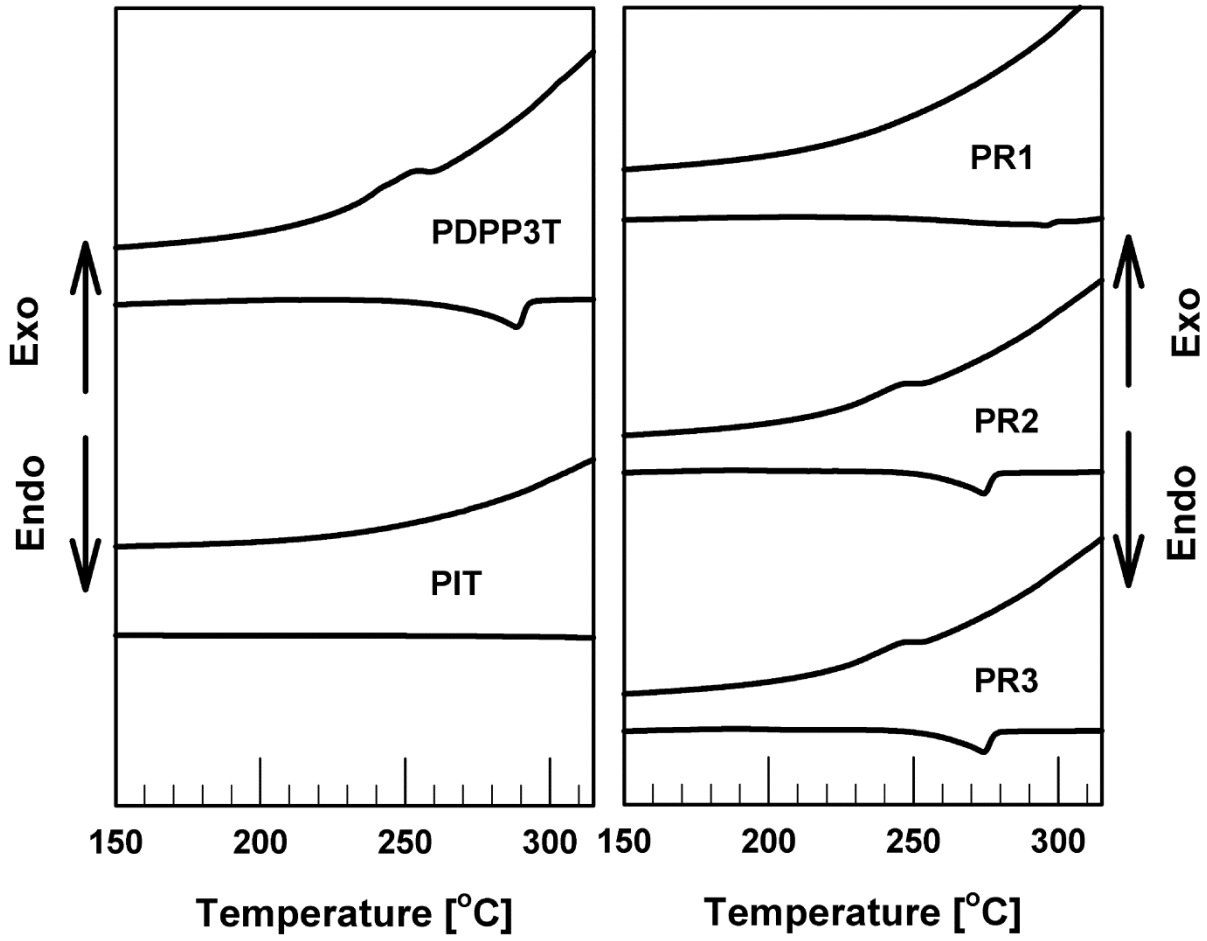

Fig. S5 DSC curves of PDPP3T, PIT and random copolymers.

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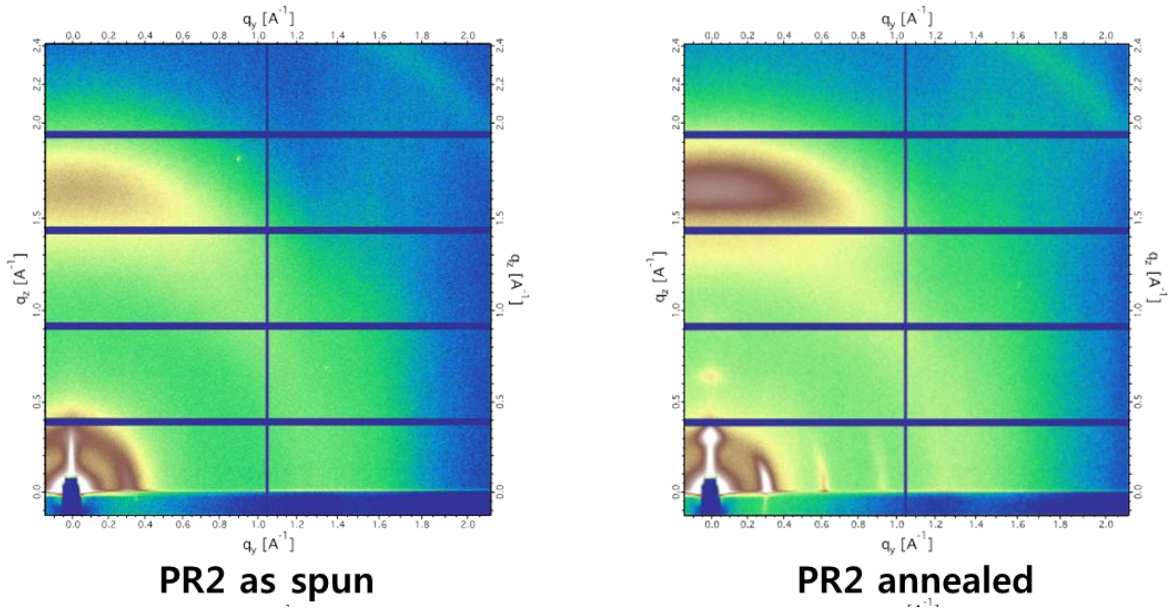

Fig. S6 2-D images of GIWAXS of random copolymer thin films.

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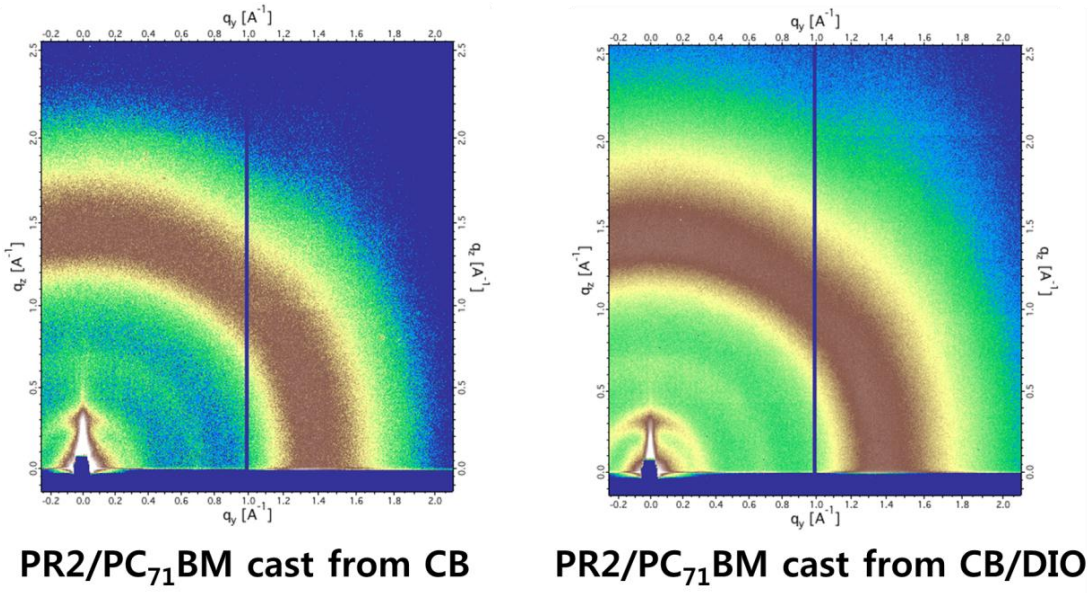

Figure S7. 2-D images of GIWAXS of PR2/PC_{71}BM thin films cast from CB without and with DIO.

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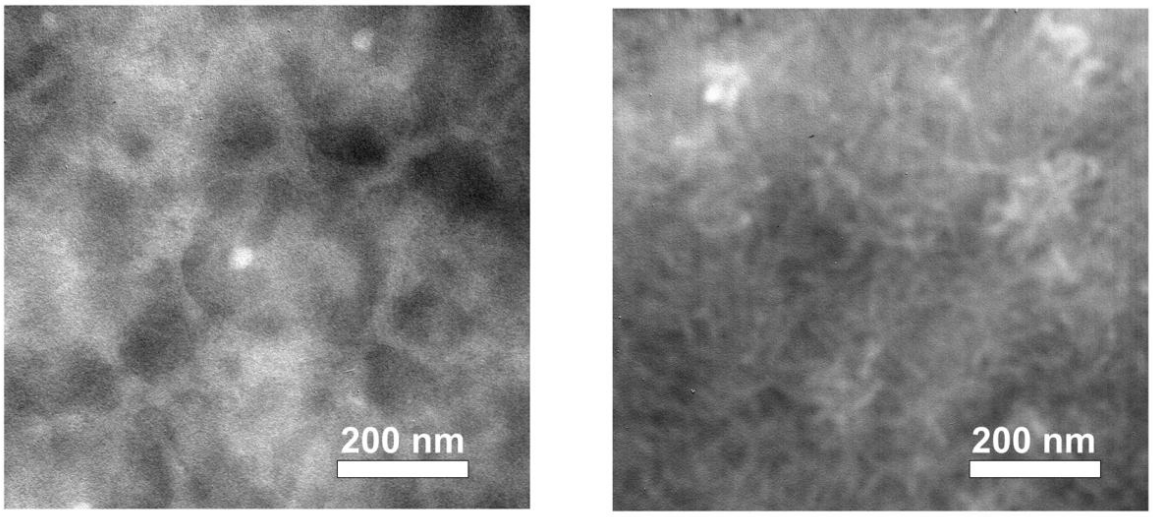

Fig. S8 TEM images of active layers from PR1/$PC_{71}BM$ and PR3/$PC_{71}BM$ under optimized condition.

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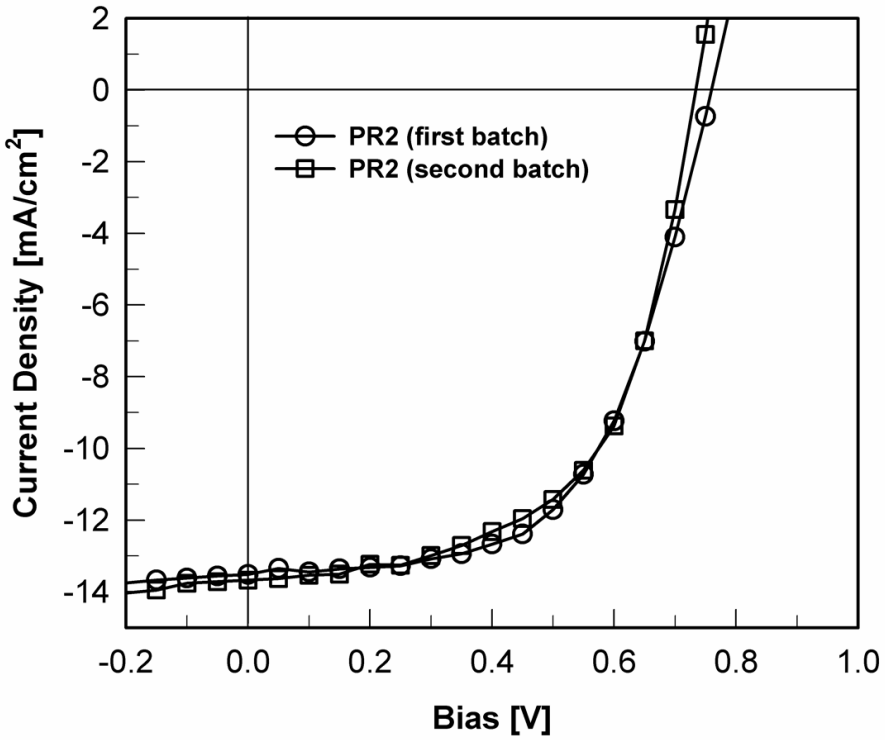

Fig. S9 *J*–*V* curves of polymer solar cells made of first and second batches of PR2, respectively.

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Table S2 Performance details of PSC devices based on different batches of PR2..

PR2	Mn (kDa)	PDI	V_{OC} (V)	J_{SC} (mA/cm^2)	FF	PCE (%)
first batch	25.3	1.17	0.77	13.52	0.58	6.04
second batch	22.7	1.26	0.74	13.67	0.58	5.87

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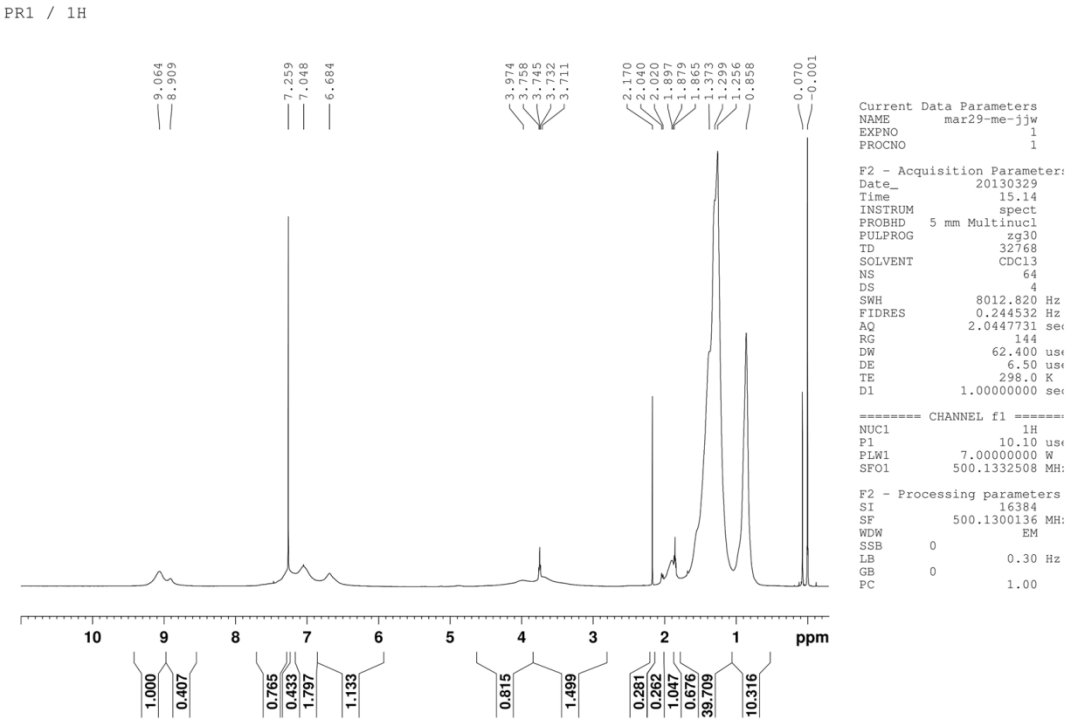

Fig. S10 ^{1}H NMR spectrum of PR1 in $CDCl_3$.

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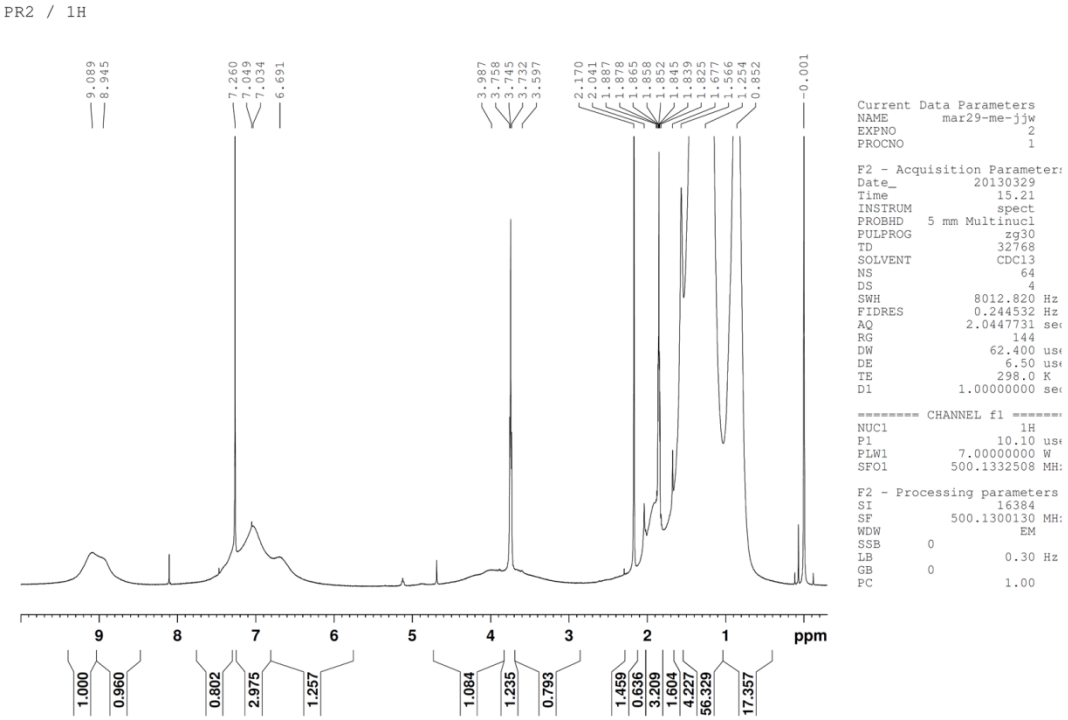

Fig. S11 ^{1}H NMR spectrum of PR2 in $CDCl_3$.

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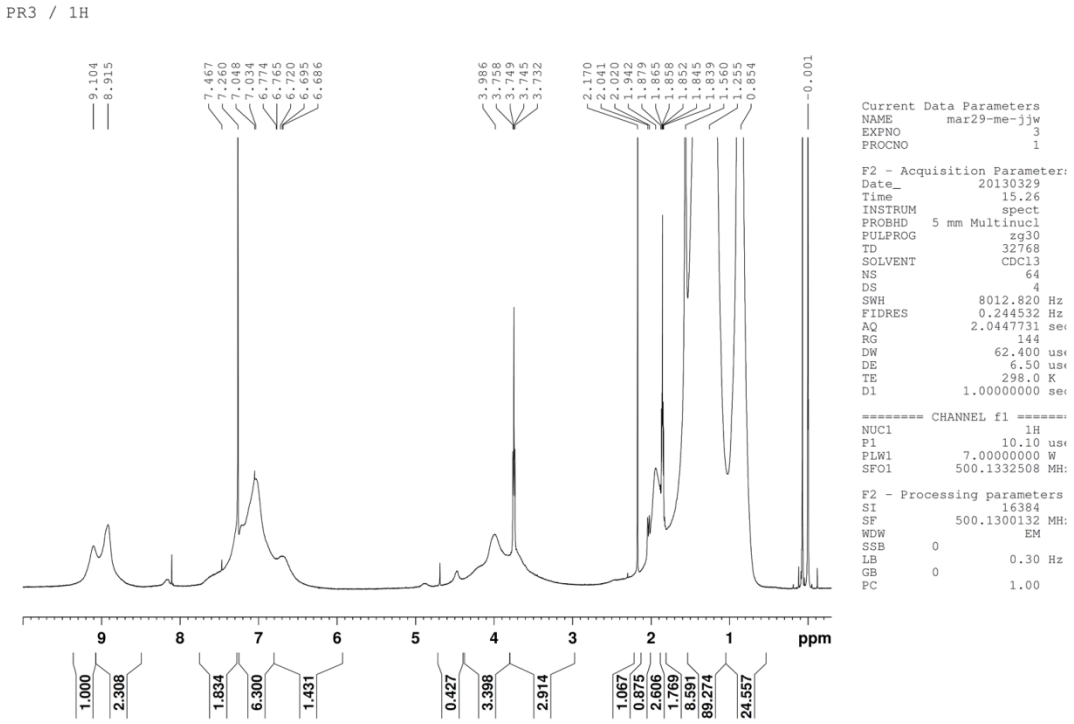

Fig. S12 ^{1}H NMR spectrum of PR3 in $CDCl_3$.

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Table S3 Comparison of feed ratio and composition of DPP to isoindigo of random copolymer

polymer	feed ratio of DPP to Isoindigo (DPP/isoindigo)	composition in random copolymer (DPP/isoindigo)
PR1	3:7 (0.43)	0.41
PR2	5:5 (1.00)	0.96
PR3	7:3 (2.33)	2.31