Electronic Supplementary information (ESI):

Influential effect of π-spacers, alkyl side chains, and of the various processing conditions on the photovoltaic properties of alkylselenyl substituted benzodithiophene based polymers

Kakaraparthi Kranthiraja,[‡a] Kumarasamy Gunasekar, [‡a] Woosum Cho,[a] Young Geun Park,[b] Jin Yong Lee,[b] Yurim Shin,[c] In-Nam Kang,[c] Myungkwan Song,[d] Keun Hwa Chae,[e] BongSoo Kim,[e] and Sung-Ho Jin*[a]

[a] *Department of Chemistry Education, Graduate Department of Chemical Materials, BK 21 PLUS Team for Advanced Chemical Materials, and Institute for Plastic Information and Energy Materials, Pusan National University, Busan, 609-735, Republic of Korea*

[b] *Department of Chemistry, Sungkyunkwan University, Suwon 440-746, Republic of Korea*

[c] *Department of Chemistry, The Catholic University of Korea, Bucheon 420-743, Republic of Korea*

[d] *Surface Technology Division, Korea Institute of Material Science, Changwon 641-83, Republic of Korea*

[e] *Advanced Analysis Center, Korea Institute of Science and Technology (KIST), Seoul 136-791, Republic of Korea*

[f] *Photo-electronic Hybrids Research Center, Korea Institute of Science and Technology (KIST), Seoul 136-791, Republic of Korea*

*Corresponding author. Tel.: +82 51 510 2727; fax: +82 51 581 2348.

E-mail addresses: shjin@pusan.ac.kr (S.-H. Jin)

‡These authors contributed equally to this manuscript.

Figure Captions

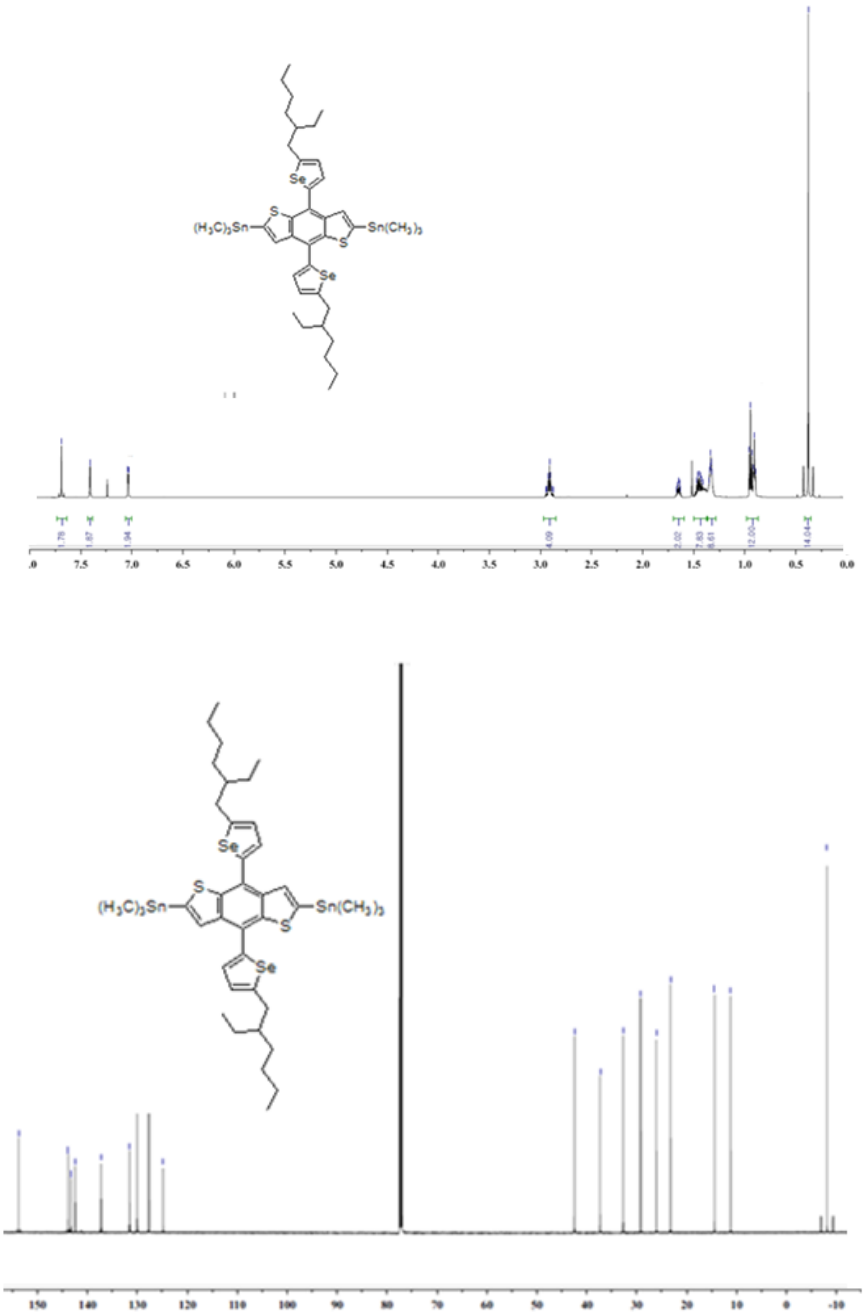


Fig. S1 ^{1}H NMR and ^{13}C NMR spectra of 2,6-bis(trimethyltin)-4,8-bis(5-2-ethylhexyl)selenophen-2-yl)benzo[1,2-b:4,5-b′]dithiophene (3a).

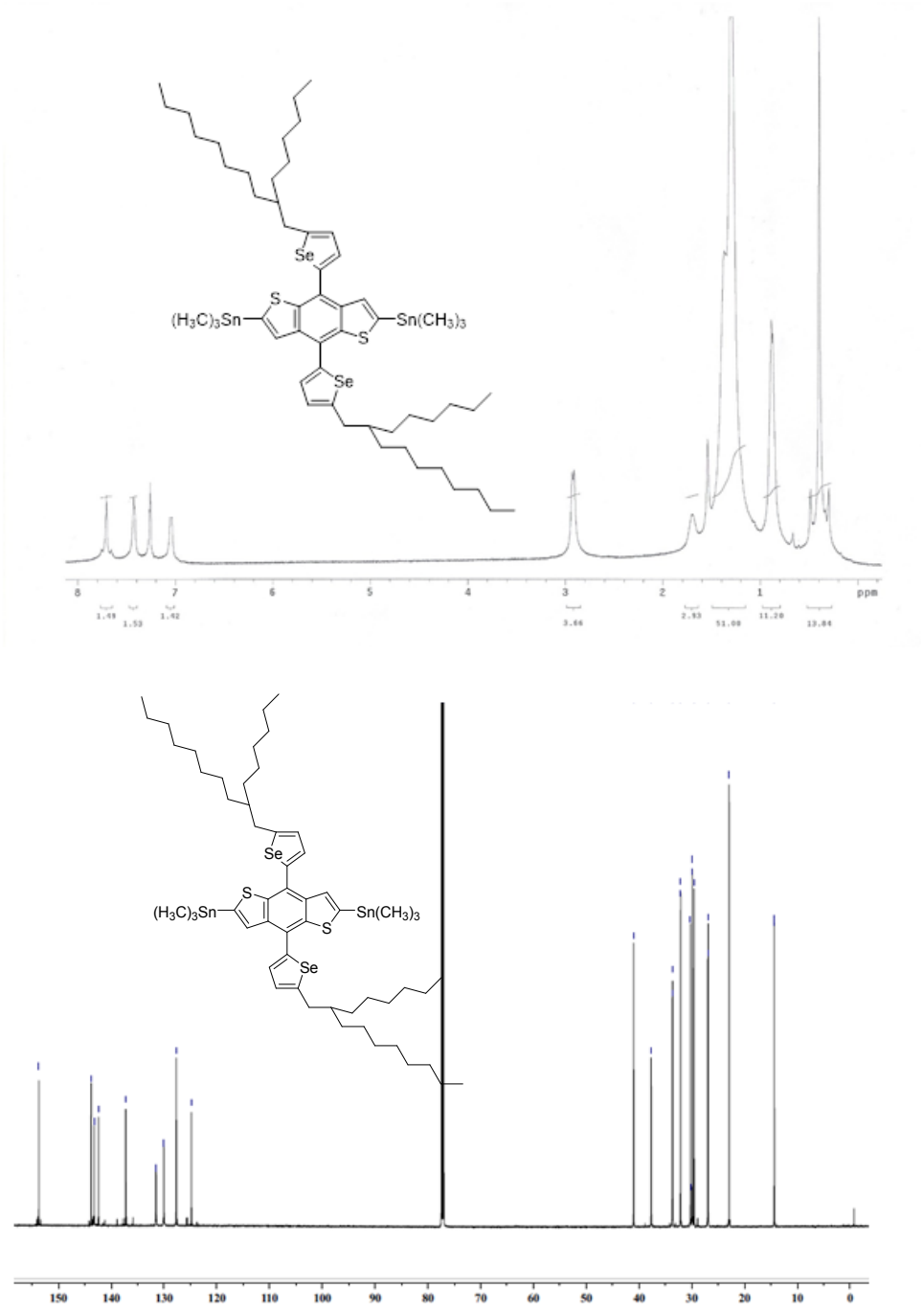


Fig. S2 ^{1}H NMR and ^{13}C NMR spectra of 2,6-bis(trimethyltin)-4,8-bis(5-2-hexyldecyl)selenophen-2-yl)benzo[1,2-b:4,5-b′]dithiophene (3b).

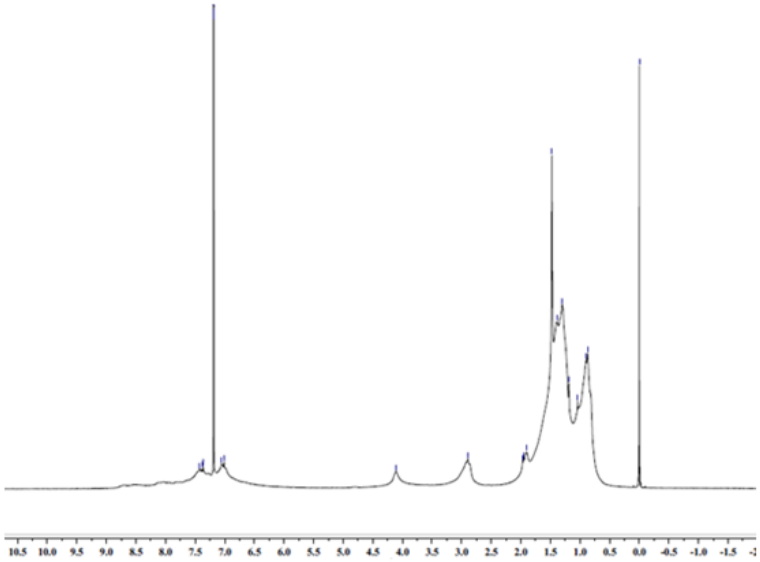


Fig. S3 ^{1}H NMR spectrum of **P1**.

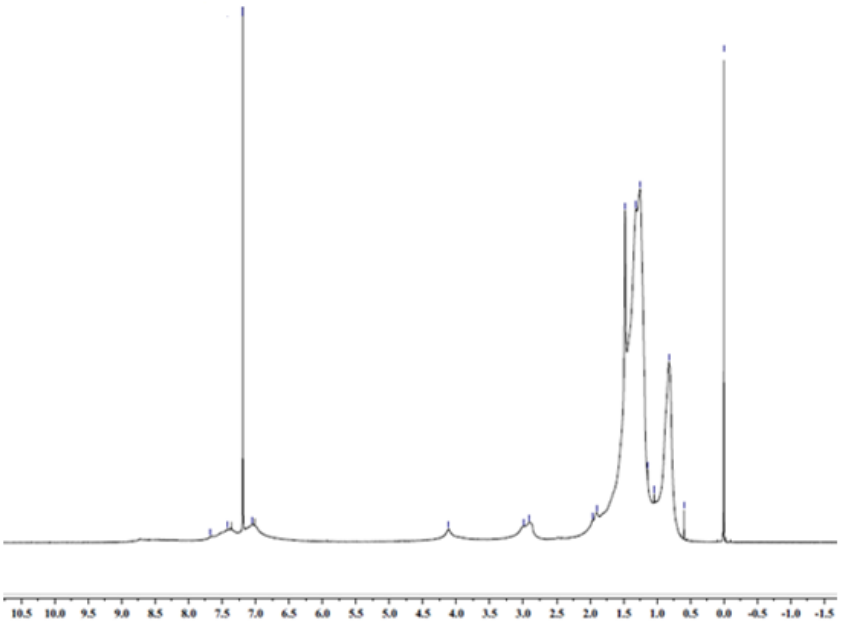


Fig. S4 ^{1}H NMR spectrum of **P2**.

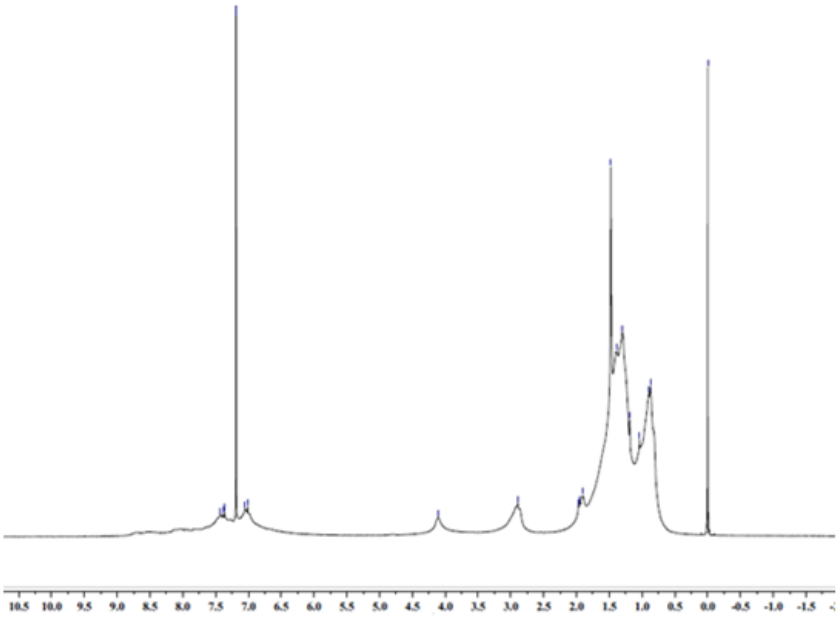


Fig. S5 ^{1}H NMR spectrum of **P3**.

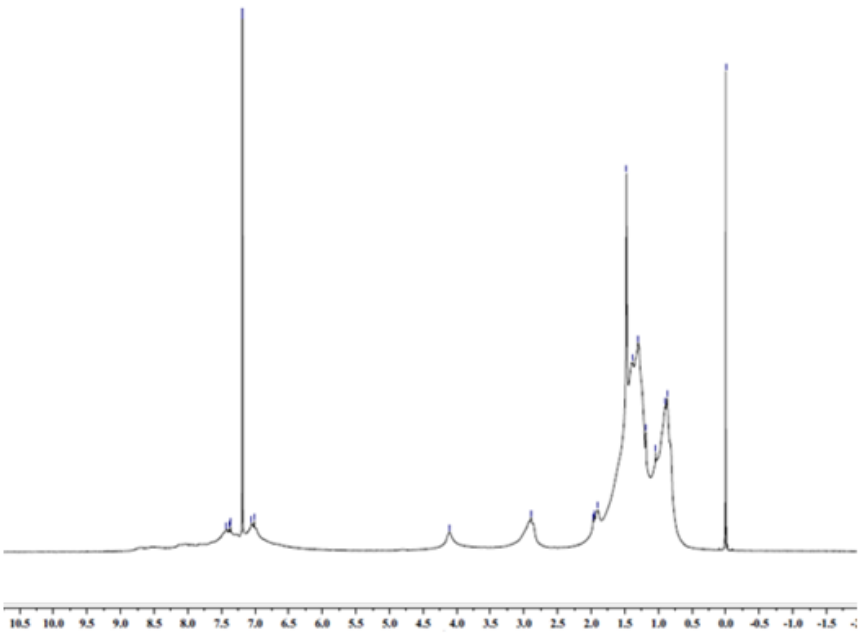


Fig. S6 ^{1}H NMR spectrum of **P4**.

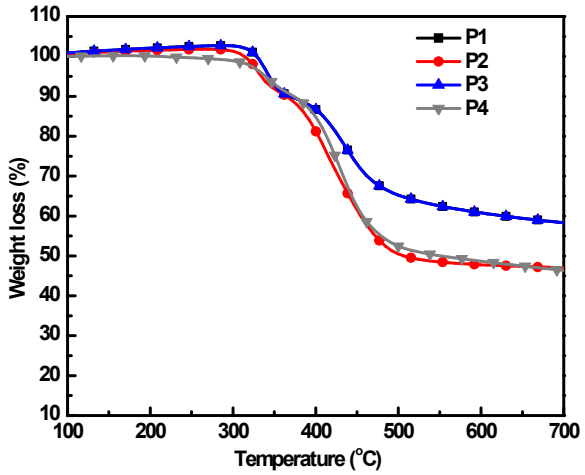


Fig. S7 TGA curves of **P1-P4**.

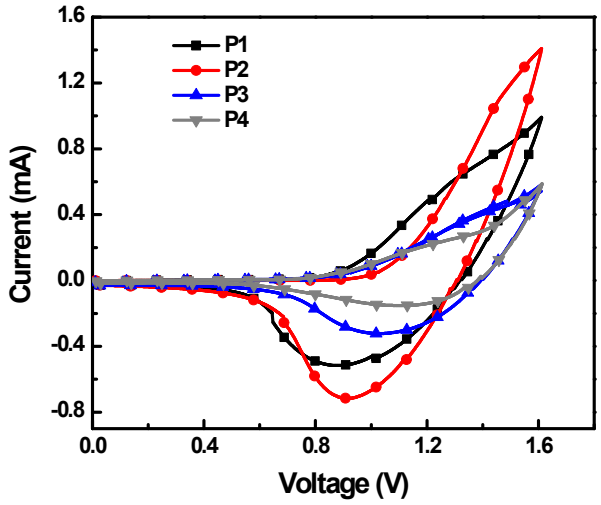
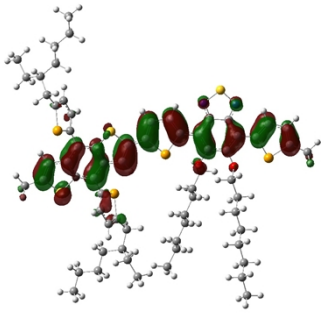
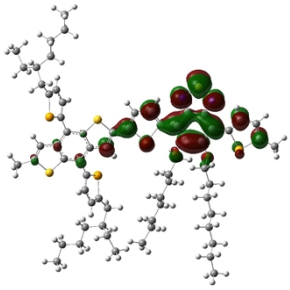
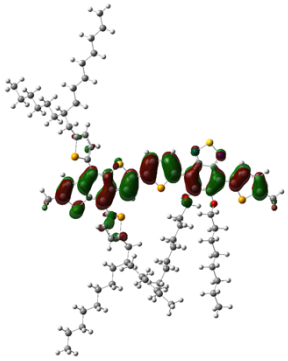
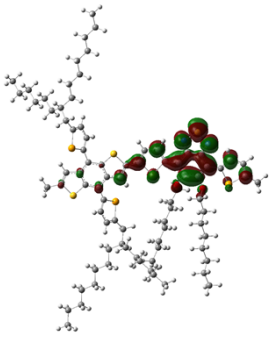
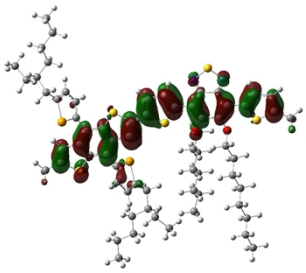
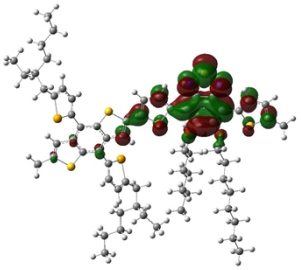


Fig. S8 Cyclic voltammograms of **P1-P4**.

	HOMO	LUMO
P1		
P2		
P3		

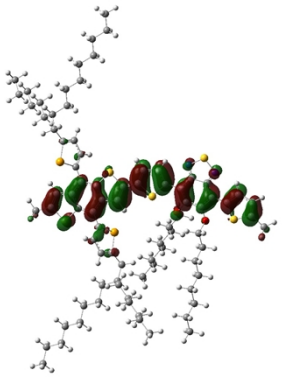
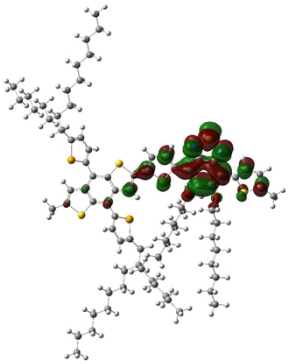
P4		

Fig. S9 DFT calculated HOMO and LUMO wave functions of geometry optimized repeating units of **P1-P4**.

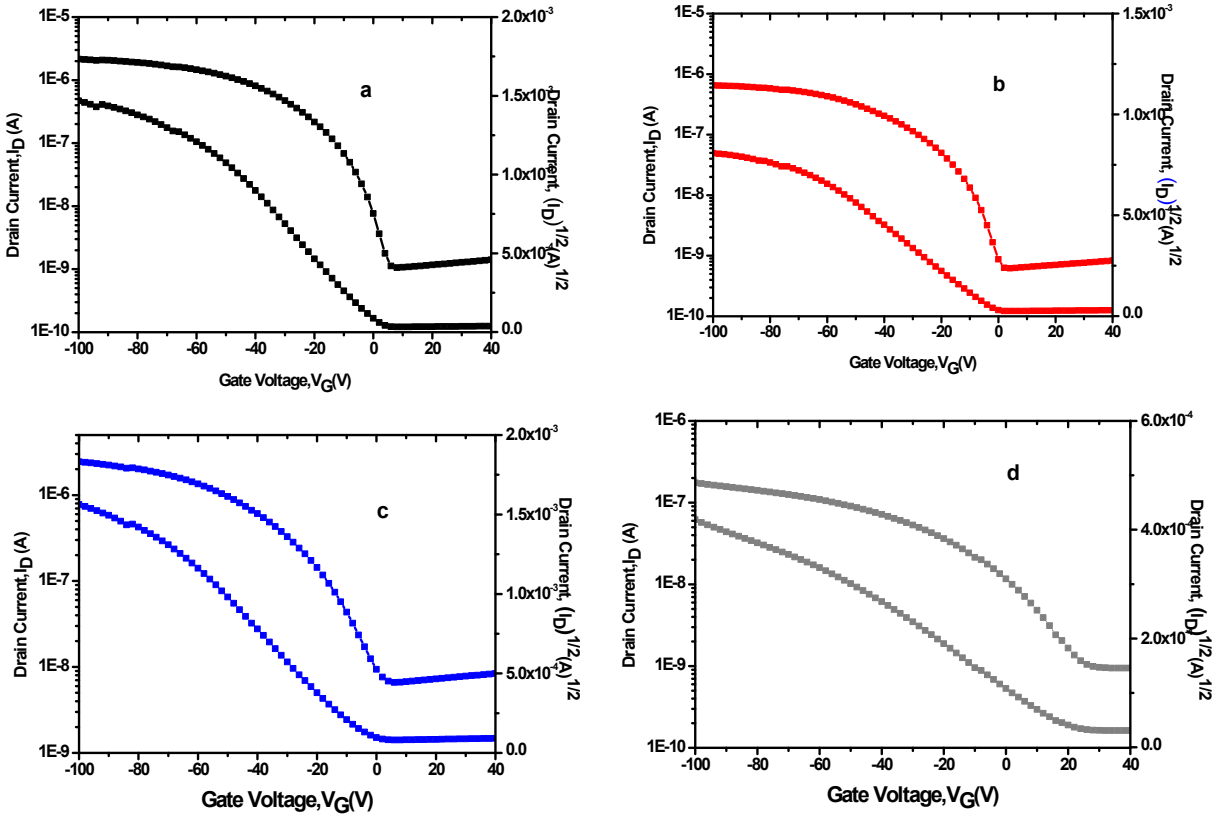


Fig. S10 Transfer characteristics of OTFTs based on devices **P1-P4.**

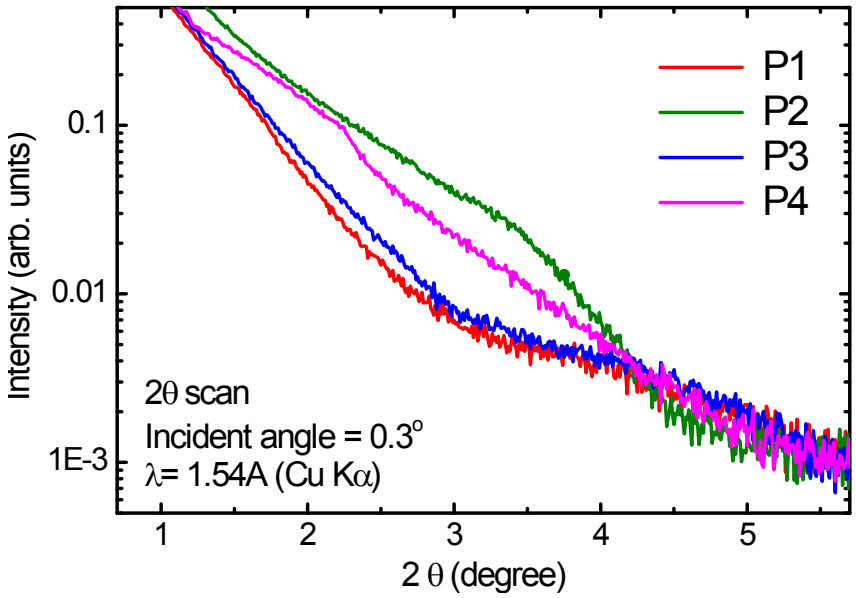


Fig. S11 X-ray diffraction pattern of **P1**-**P4** films.

Table S1. Molecular weights and thermal properties of **P1-P4**

Polymer	M_w [a] (g/mol)	M_n [a] (g/mol)	PDI	T_d (°C)[b]
P1	82000	46000	1.78	342
P2	97000	45000	1.76	334
P3	110000	59000	1.86	342
P4	92000	51000	1.80	340

[a] M_w, M_n and PDI were determined by gel permeation chromatography (GPC) in THF.

[b] Decomposition temperature at 5% weight loss.

Table S2. OTFT device characteristics of **P1-P4**

Polymer	$T_{annealing}$ (°C)	μ_{hole} ($cm^2V^{-1}s^{-1}$)	I_{on}/I_{off}
P1	140	5.5×10^{-3}	1×10^3
P2	140	2.3×10^{-3}	1×10^5
P3	140	7.3×10^{-3}	5×10^2
P4	140	3.1×10^{-4}	1×10^2

Table S3. Evaluation of the photovoltaic properties of the OPVs based on polymer:$PC_{71}BM$ 1-chloronapthalene (CN) additive under the illumination of AM 1.5G, 100 mW/cm^2

Polymer	Polymer:$PC_{71}BM$ (wt%)	Solvent	J_{sc} (mA/cm^2)	V_{oc} (V)	FF (%)	PCE (%)
P1[a]	1:2	CB	11.74	0.68	52.97	4.23
P2[a]	1:2	CB	11.50	0.71	57.33	4.69
P3[a]	1:1	CB	12.34	0.68	47.60	4.04
P4[a]	1:1	CB	10.28	0.71	56.76	4.16

[a] 1 vol% CN was used.