Electronic Supplementary Material (ESI) for Polymer Chemistry.

Electronic Supplementary Information

Highly efficient photovoltaics and field-effect transistors based on copolymers of mono-fluorinated benzothiadiazole and quarterthiophene: synthesis and effect of the molecular weight on device performance

Minghui Hao,[a] Xiaodong Li,[b] Keli Shi,[c] Dongjun Xie,[a] Xuan Zeng,[a] Junfeng Fang,*[b] Gui Yu*[c] and Chuluo Yang*[a]

[a]Hubei Collaborative Innovation Center for Advanced Organic Chemical Materials, Hubei Key Lab on Organic and Polymeric Optoelectronic Materials, Department of Chemistry, Wuhan University, Wuhan 430072, China

[b]Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo 315201, China

[c]Beijing National laboratory for Molecular Sciences, Key Laboratory of Organic Solids, Institute of Chemistry, Chinese Academy of Sciences, Beijing 100080, China

Table S1: Optimized Electrical Parameters of Field-effect Transistors at Different Annealing Temperatures.

polymer	annealing temperature (°C)	μ_h (cm^2 V^{-1} s^{-1})
H-P4TFBT	25	0.14
	80	0.32
	120	0.31
	160	0.39
	200	0.36
	240	0.37
	280	0.04

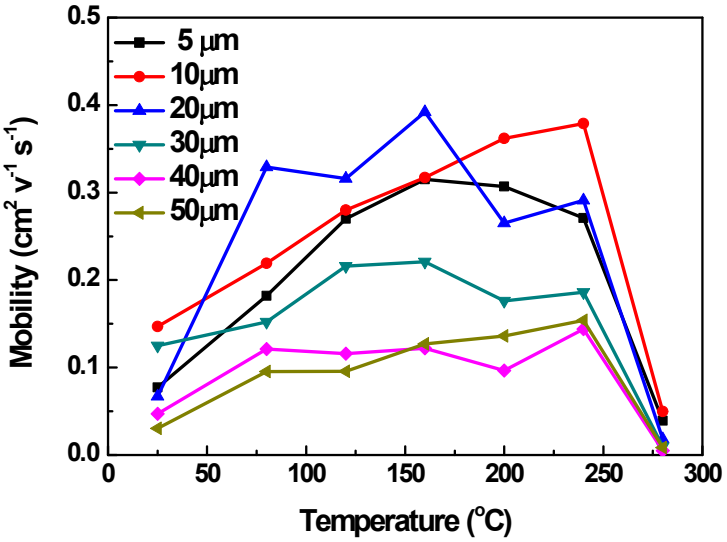


Fig. S1 Evolution of field-effect hole mobilities for **H-P4TFBT** with different channel length (L) and different annealing temperatures (T).

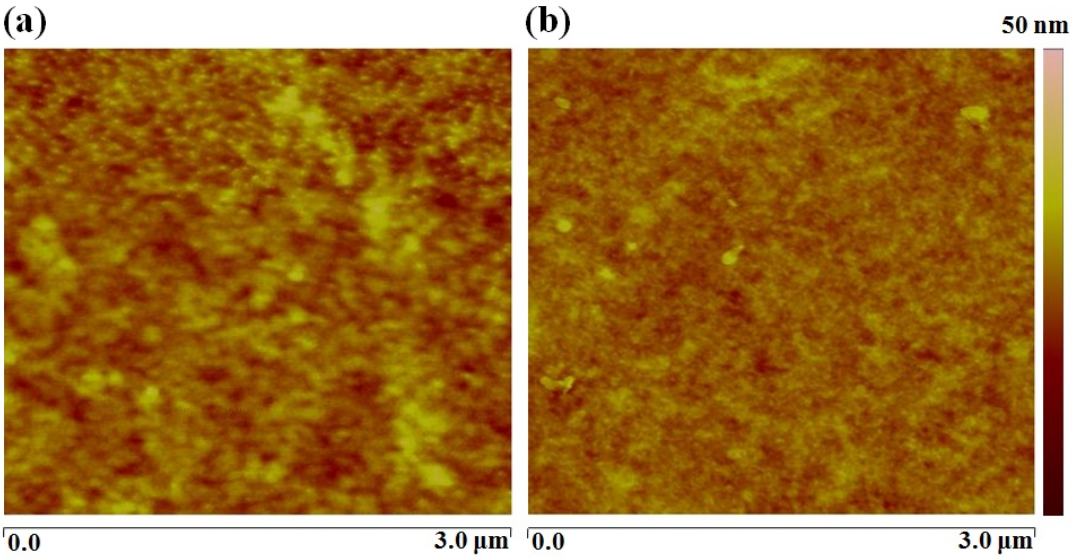


Fig. S2 AFM topographical height images (3 μm × 3 μm) of **H-P4TFBT** on OTS-modified SiO_2/Si substrates. (a) without annealing and (b) with annealing at 160 °C.

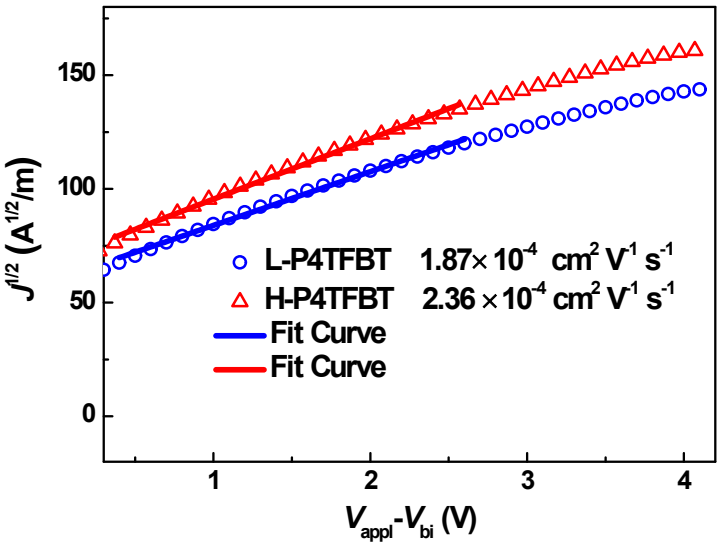


Fig. S3 Current voltage characteristics of **P4TFBT** blends with $PC_{71}BM$ in SCLC devices, and the lines are fitted according to the SCLC model.

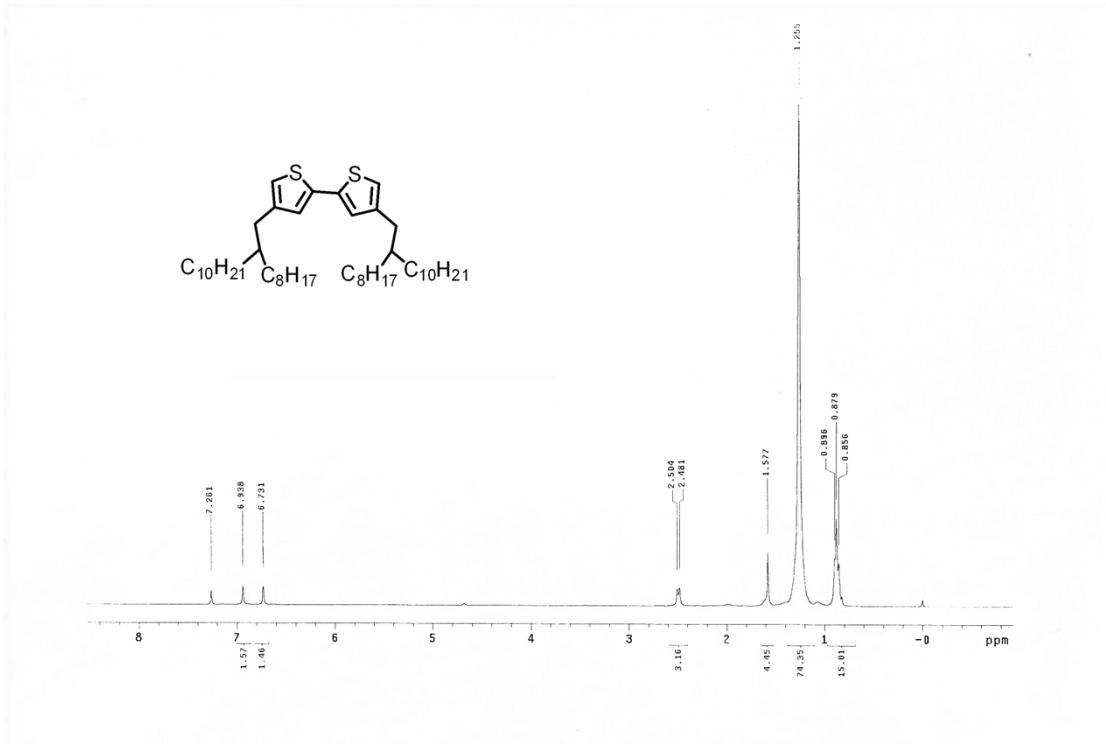


Fig. S4 ^{1}H NMR of 4,4'-bis(2-octyldodecyl)-2,2'-bithiophene.

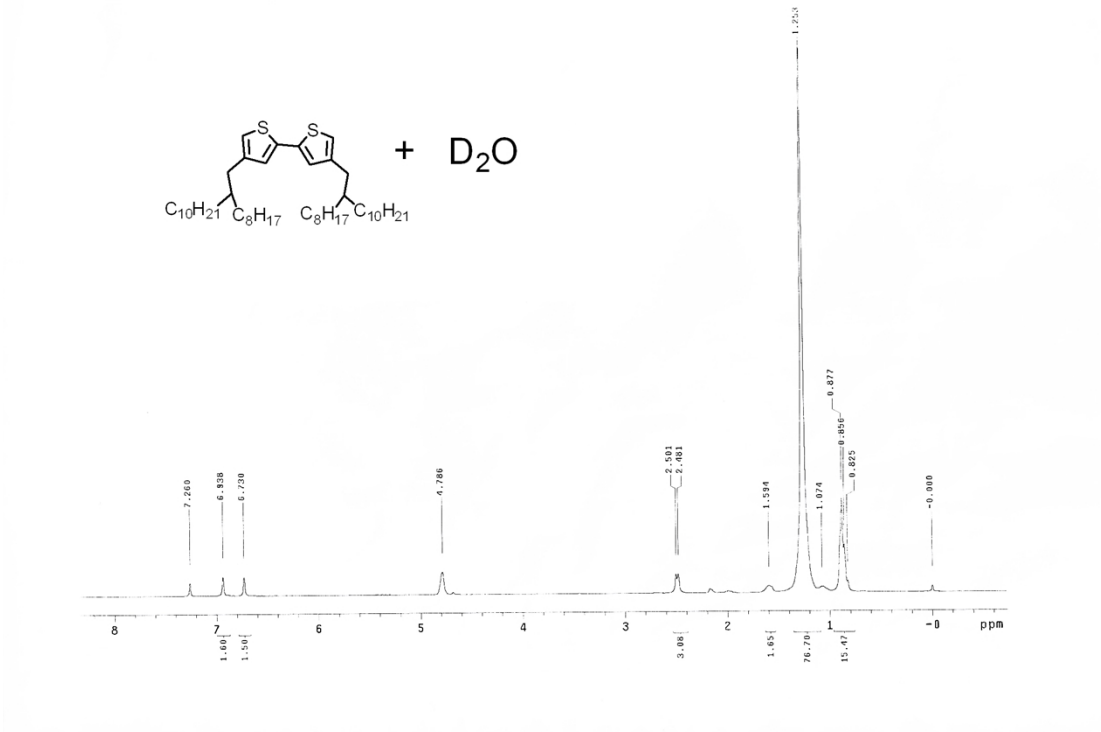


Fig. S5 ^{1}H NMR of 4,4'-bis(2-octyldodecyl)-2,2'-bithiophene and a drop of D_2O.

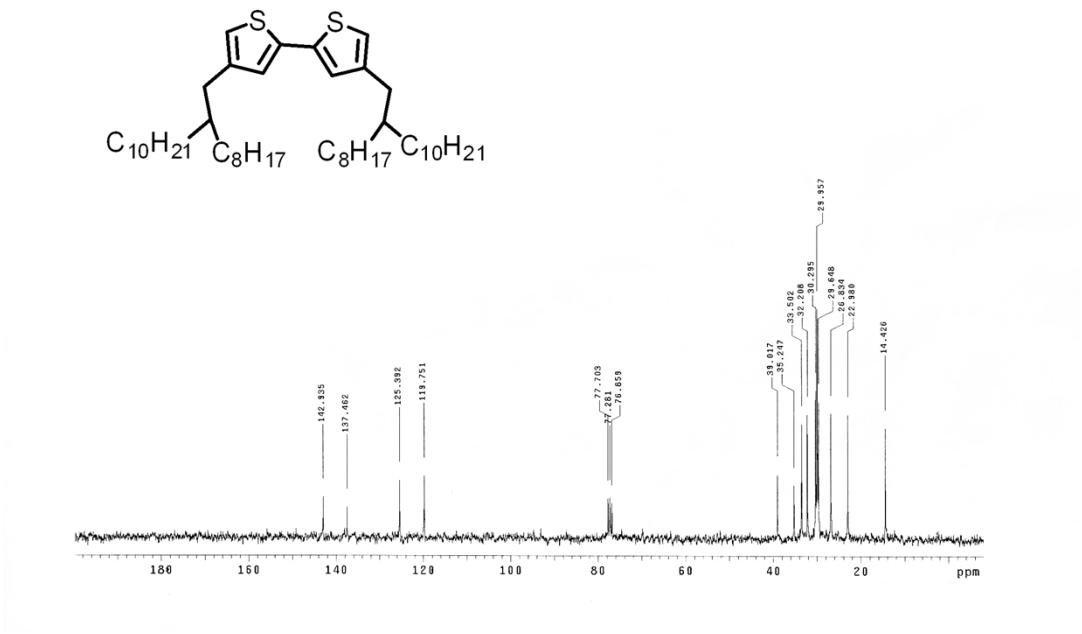


Fig. S6 ^{13}C NMR of 4,4'-bis(2-octyldodecyl)-2,2'-bithiophene.

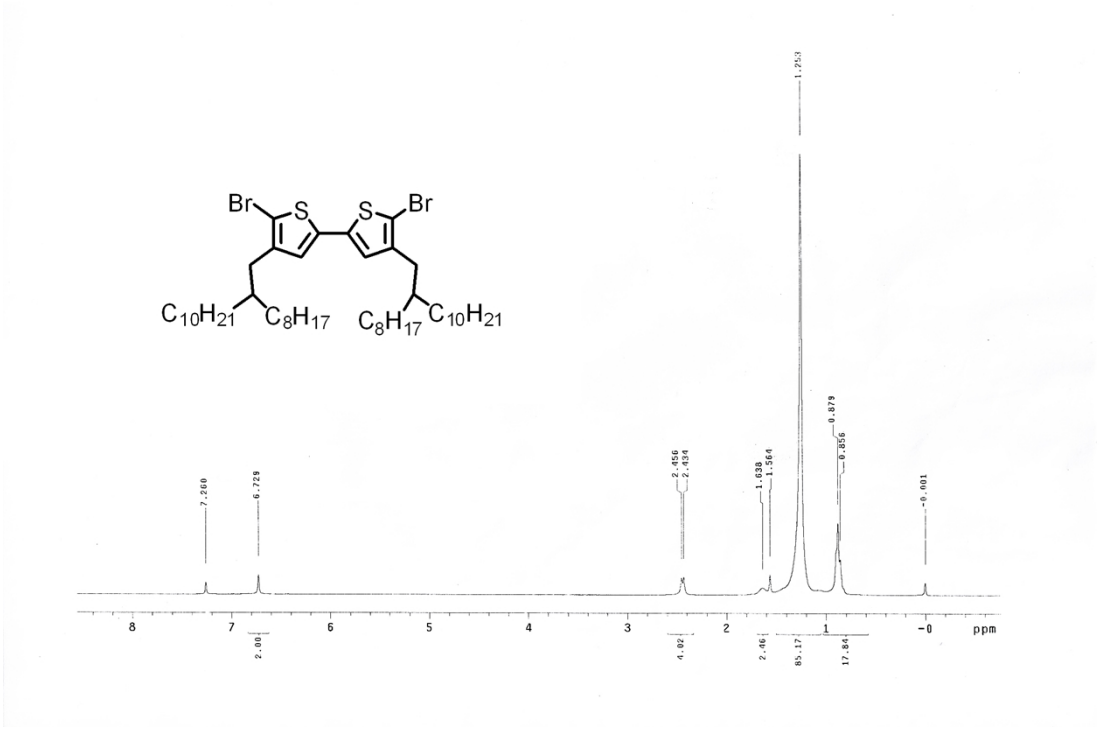


Fig. S7 ^{1}H NMR of 5,5'-dibromo-4,4'-bis(2-octyldodecyl)-2,2'-bithiophene.

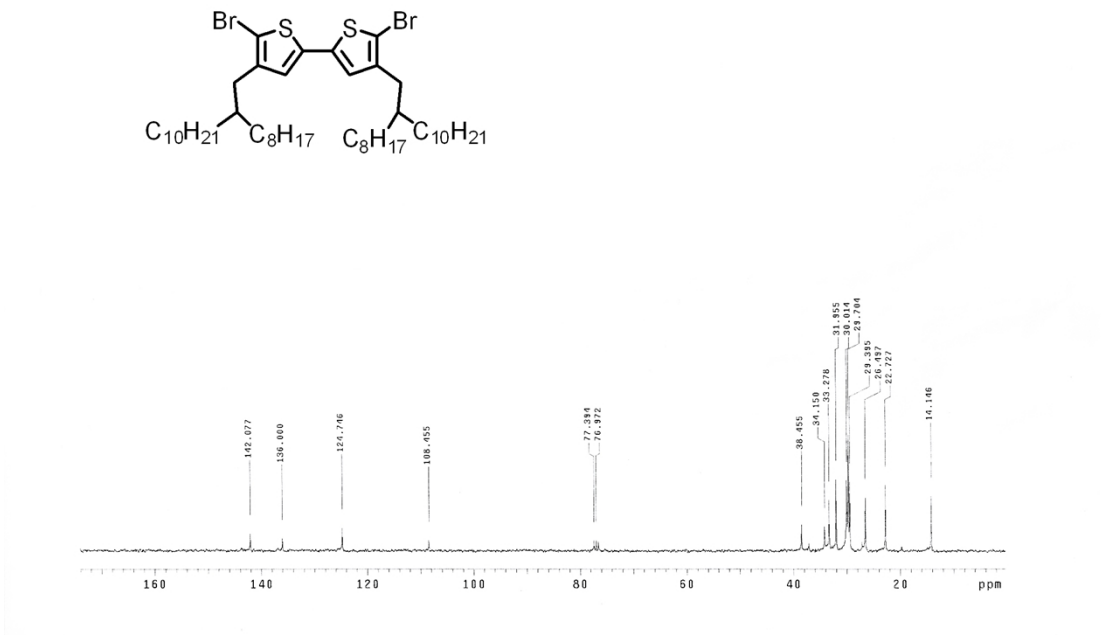
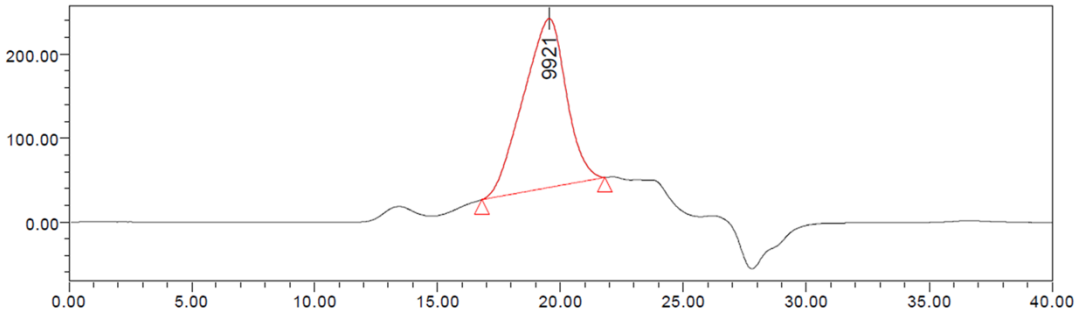


Fig. S8 ^{13}C NMR of 5,5'-dibromo-4,4'-bis(2-octyldodecyl)-2,2'-bithiophene.

M_n	M_w	PDI (M_w/M_n)
10.0	13.5	1.3



Waters 2690D Separations Module Waters 2410 Refractive Index Detector
Solvent: thf Flow Rate :0.3 ml.min-1 Standards : Polystyrene Standard
Temperature: Column: 313K Detector: 308K

Fig. S9 Molecular weight distribution of **L-P4TFBT** measured at room temperature in tetrahydrofuran against PS standards.

M_n	M_w	PDI (M_w/M_n)
37.0	46.8	1.3

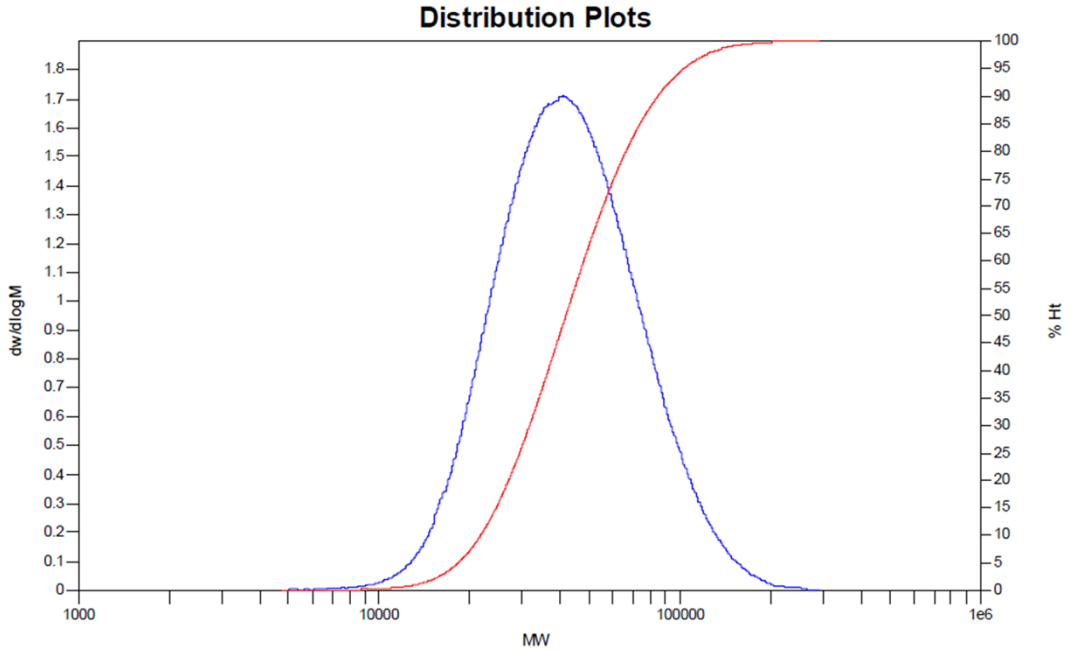


Fig. S10 Molecular weight distribution of **H-P4TFBT** measured at 150 °C in TCB against PS standards.