

Supporting information for

Synthesis of copolymers based on bisthiophene fused diketopyrrolopyrrole and their
application in near-infrared phototransistors

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Table S1 Relationship between solution concentration and film thickness

Solution concentration (mg/mL)	10	7.5	5
Film thickness (nm)	85	58	36

Table S2 Relationship between weight ratio of polymer/PC₇₁BM and root-mean-square (RMS) roughness (nm)

weight ratio	1:0	9:1	4:1	2:1	1:1	1:2
P1/PC71BM	3.8	2.01	3.65	6.78	11.8	19.3
P2/PC71BM	11.8	7.11	3.33	6.8	9.53	11

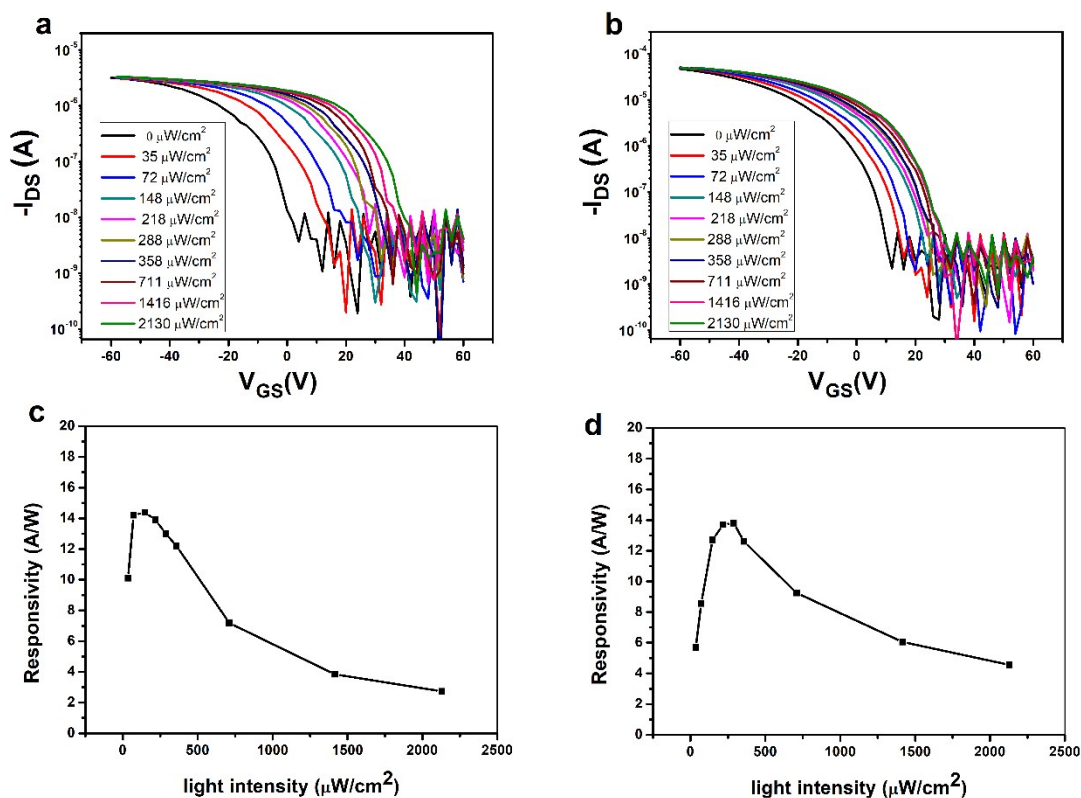


Fig. S1 Transfer characteristics of NIR phototransistors based on P1 (a) and P2 (b) in the dark and under 850 nm light irradiation with various light intensity.

Photoresponsivity of NIR phototransistors based on P1 (c) and P2 (d) with increased illumination intensity.

Table S3 Threshold voltage under different light intensity of phototransistors based on pure P1 and P2 film

	dark	35 μW	72 μW	148 μW}	.....	2130 μW
P1	-3	2	12	18	.....	41
P2	5	10	13	17	.....	25

Table S4 Photo response performance based on P1/PC₇₁BM with different weight

ratio

Weight ratio	Mobility ($\text{cm}^2\text{V}^{-1}\text{s}^{-1}$)	photocurrent/dark current ratio	photoresponsivity (A/W)
9:1	0.005	3.8×10^3	173
4:1	0.005	6.8×10^3	203
2:1	0.005	8.2×10^3	245
1:1	0.004	3.6×10^4	270
1:2	0.003	1.1×10^4	78

Table S5 Threshold voltage under different light intensity of phototransistors based on P1/PC₇₁BM with different weight ratio

Weight ratio	dark	35 μ W	72 μ W	148 μ W	.....	2130 μ W
9:1	7	38	44	51	.....	59
4:1	16	45	50	53	.....	57
2:1	11	45	50	53	.....	57
1:1	0	38	45	48	.....	54
1:2	10	34	40	46	.....	53

Table S6 Photo response performance based on P1/PC₇₁BM (weight ratio 1:1) with different film thickness

Film thickness (nm)	Mobility ($\text{cm}^2\text{V}^{-1}\text{s}^{-1}$)	photocurrent/dark current ratio	photoresponsivity (A/W)
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85	0.004	3.6×10^4	270
58	0.003	1.9×10^3	150
36	0.002	2.1×10^3	47

Table S7 Threshold voltage under different light intensity of phototransistors based on P1/PC₇₁BM (weight ratio 1:1) with different film thickness

Film thickness (nm)	dark	35μW	72μW	148μW	.....	2130μW
85	0	38	45	48	.....	54
58	0	37	41	46	.....	57
36	0	22	30	36	.....	53

Table S8 Photo response performance based on P2/PC₇₁BM with different weight ratio

Weight ratio	Mobility (cm ² V ⁻¹ s ⁻¹)	photocurrent/dark current ratio	photoresponsivity (A/W)
9:1	0.050	2.5×10^4	2420
4:1	0.050	2.7×10^4	1580
2:1	0.043	4.1×10^4	1220
1:1	0.024	3.3×10^4	363
1:2	0.008	5.2×10^3	145

Table S9 Threshold voltage under different light intensity of phototransistors based on P2/PC₇₁BM with different weight ratio

Weight ratio	dark	35μW	72μW	148μW	.....	2130μW
9:1	1	39	45	49	.....	52
4:1	7	41	48	53	.....	57
2:1	2	36	41	46	.....	52
1:1	-1	26	37	47	.....	56
1:2	-3	27	35	42	.....	50

Table S10 Photo response performance based on P2/PC₇₁BM (weight ratio 9:1) with different film thickness

Film thickness	Mobility	photocurrent/dark	photoresponsivity
(nm)	(cm ² V ⁻¹ s ⁻¹)	current ratio	(A/W)
85	0.050	2.5×10^4	2420
58	0.050	8.1×10^2	597
36	0.030	72	52

Table S11 Threshold voltage (V) under different light intensity of phototransistors based on P2/PC₇₁BM (weight ratio 9:1) with different film thickness

Film thickness	dark	35μW	72μW	148μW		2130μW
(nm)						

85	1	39	45	49	.....	52
58	5	22	36	47	.....	56
36	10	21	31	41	.....	55

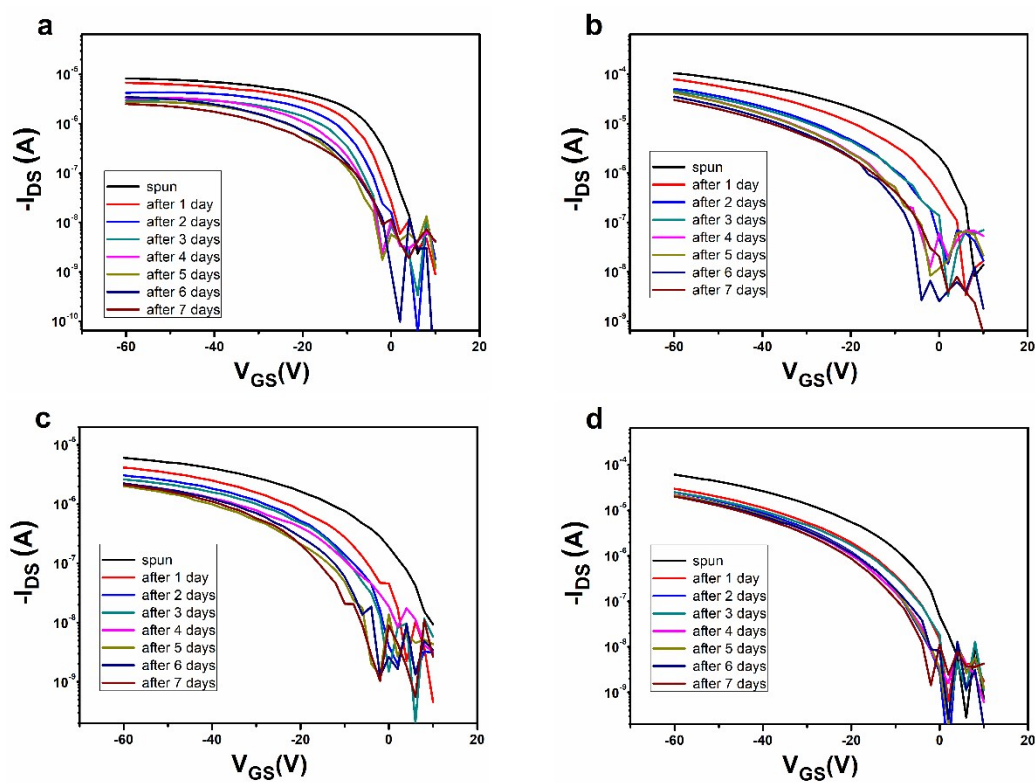


Fig. S2 Device stability (transfer characteristic) over one week (OFETs with P1 (a), P2 (b), P1/PC₇₁BM (c) and P2/PC₇₁BM (d) as semiconductor layer)

NMR spectra

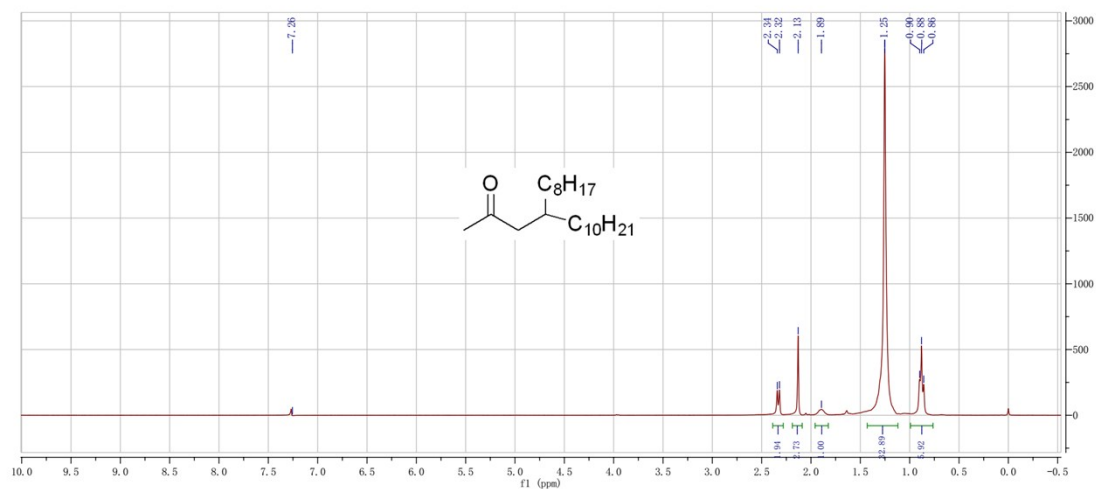


Fig. S3 ¹H NMR spectrum of compound 2

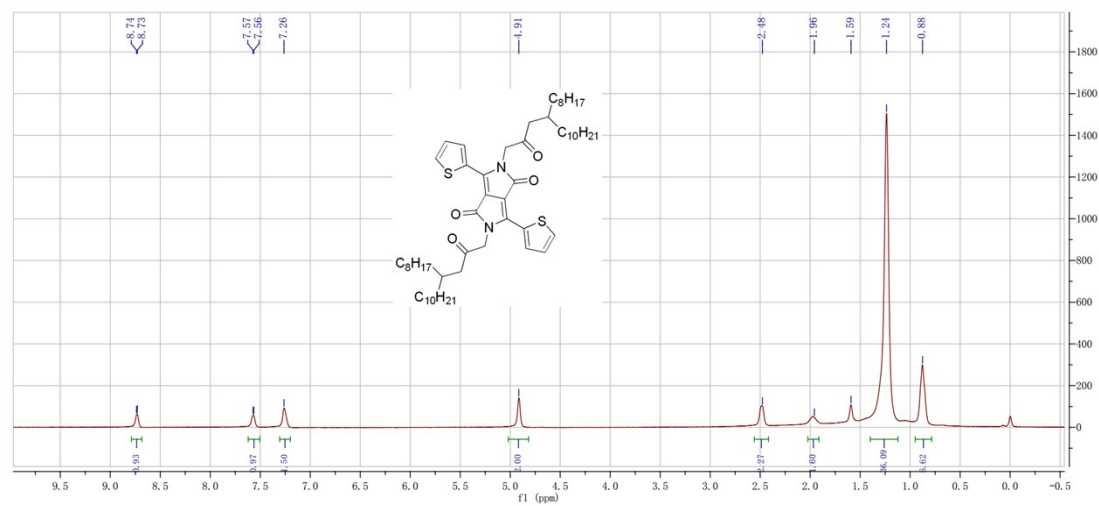


Fig. S4 ¹H NMR spectrum of compound 5

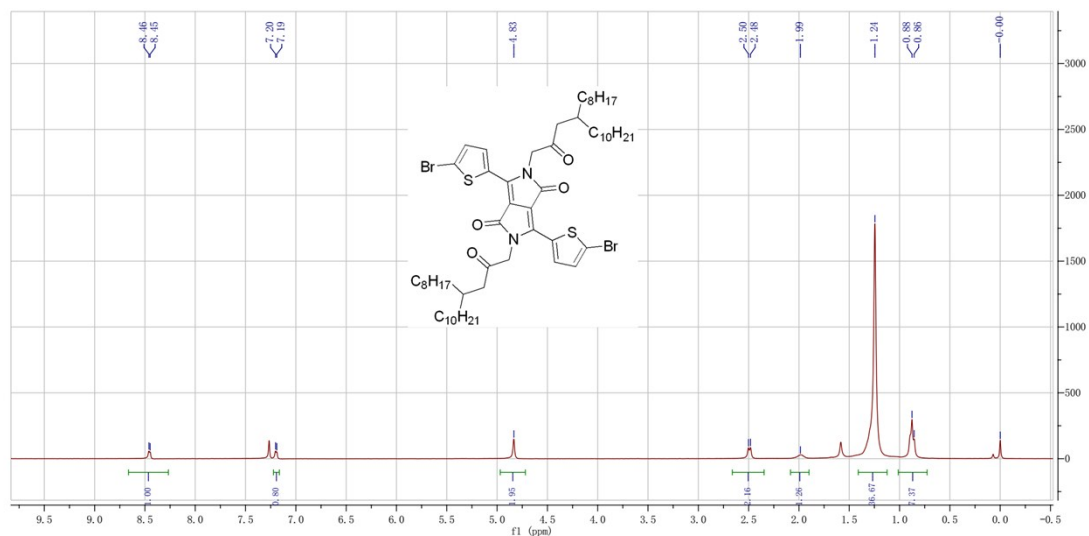


Fig. S5 ^1H NMR spectrum of compound 6

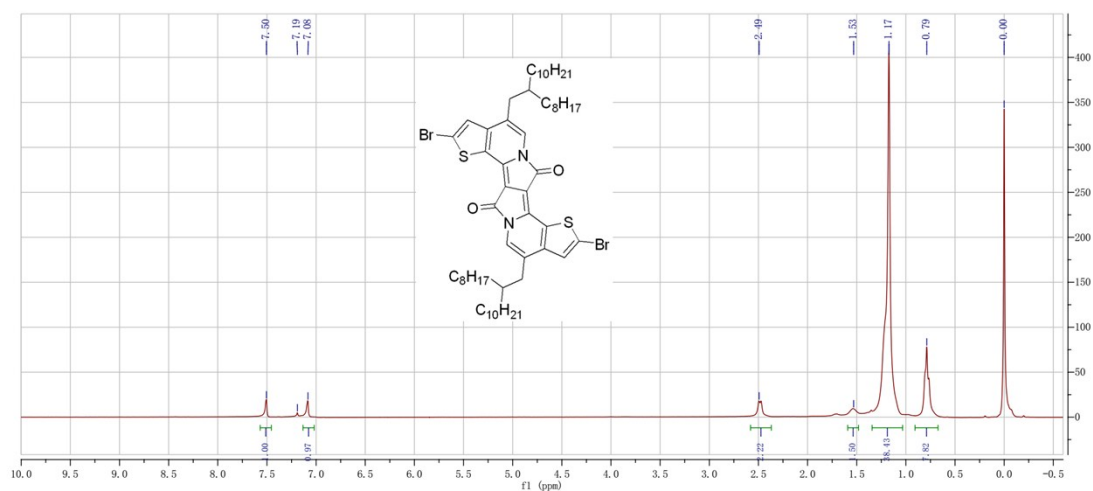


Fig. S6 ^1H NMR spectrum of compound 7