

Electronic Supplementary Information

An effective π -extended squaraine for solution-processed organic solar cell with high efficiency

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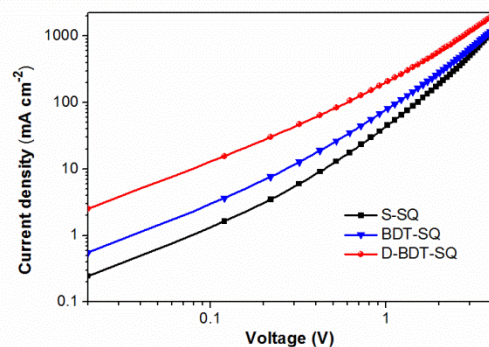


Fig. S1 J - V characteristic of the single hole-carrier devices based on neat film.

Table S1 Photovoltaic performances of OSCs based on **D-BDT-SQ**: PC₇₁BM blend films with different weight ratios.

Active layer (w/ w)	V_{oc}	J_{sc}	FF	PCE ^a
Thickness (60 nm)	(V)	(mA cm ⁻²)		(%)
1 : 1	0.88 (0.88)	7.77 (7.48)	0.38 (0.38)	2.60 (2.50)
1 : 3	0.90 (0.90)	11.25 (11.07)	0.50 (0.50)	5.06 (4.98)
1 : 5	0.90 (0.90)	11.90 (11.76)	0.50 (0.50)	5.35 (5.29)
1 : 6	0.92 (0.92)	11.85 (11.54)	0.51 (0.50)	5.56 (5.31)
1 : 7	0.91 (0.91)	11.75 (11.53)	0.52 (0.52)	5.56 (5.46)
1 : 8	0.92 (0.92)	11.27 (11.16)	0.51 (0.51)	5.29 (5.24)
1 : 9	0.93 (0.93)	10.93 (10.74)	0.51 (0.51)	5.18 (5.09)

^a Average values of 8 individual cells were given in parentheses.

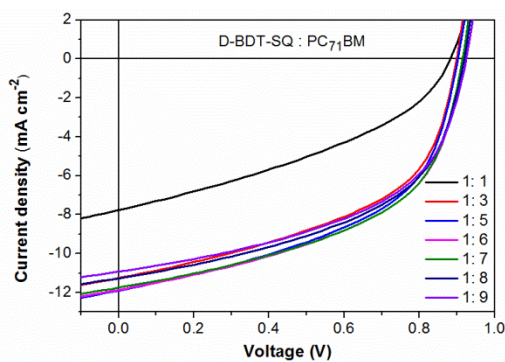


Fig. S2 J - V curve of OSCs devices based on **D-BDT-SQ**: PC₇₁BM blend films with different weight ratios.

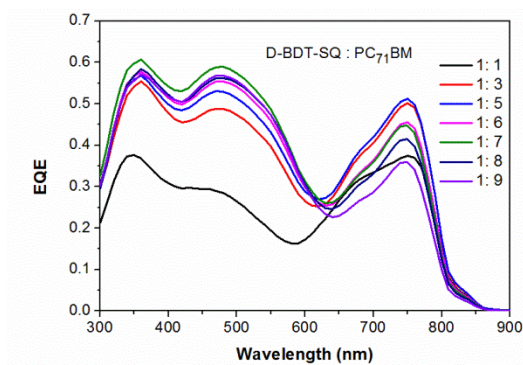


Fig. S3 EQE curve of OSCs devices based on **D-BDT-SQ: PC₇₁BM** blend films with different weight ratios.

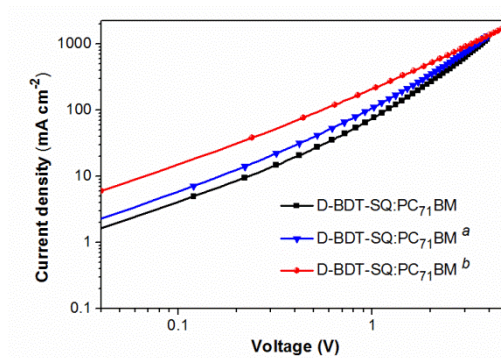
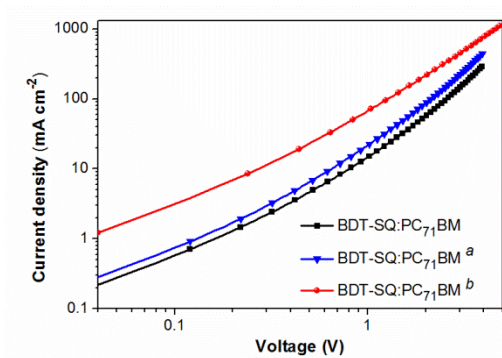
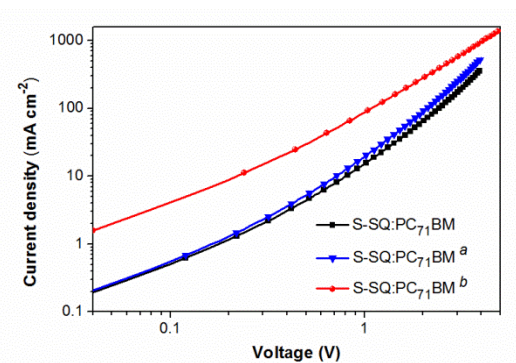


Fig. S4 *J-V* characteristic of the single hole-carrier devices based on SM:PC₇₁BM (1:7) blend film. ^a Thermally annealed devices (80 °C for 15 min). ^b Thermally tested devices (at 80 °C).

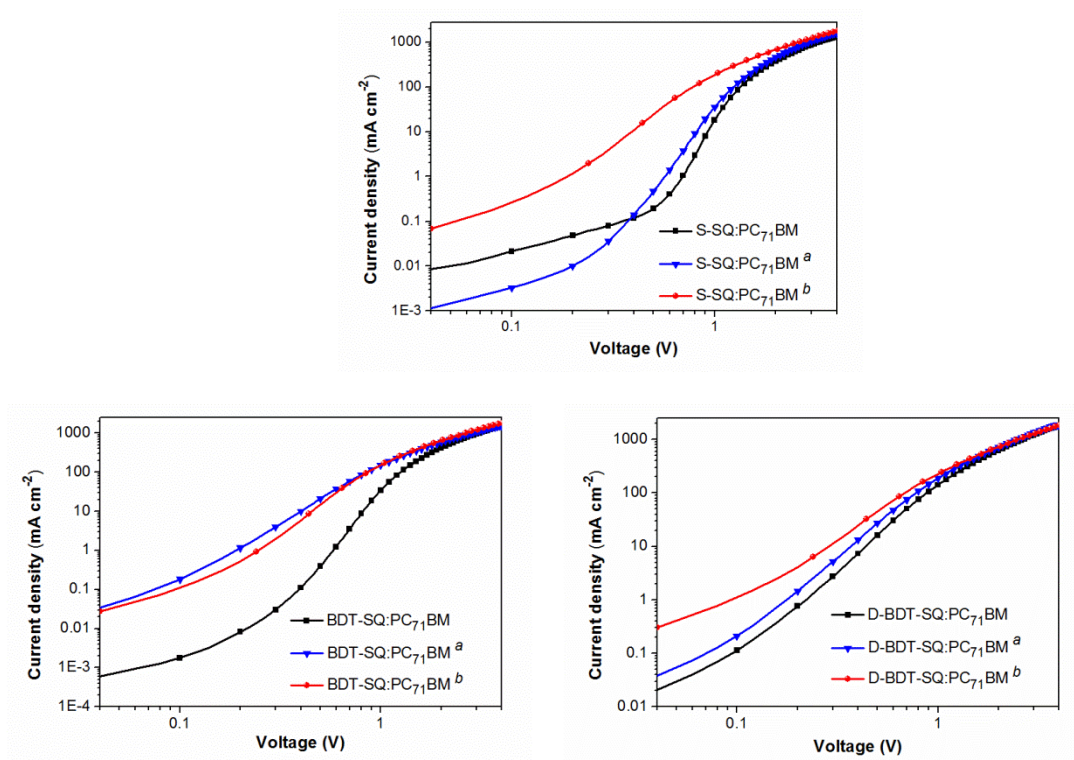


Fig. S5 J - V characteristic of the single electron-carrier devices based on SM:PC₇₁BM (1:7) blend film. ^a Thermally annealed devices (80 °C for 15 min). ^b Thermally tested devices (at 80 °C).

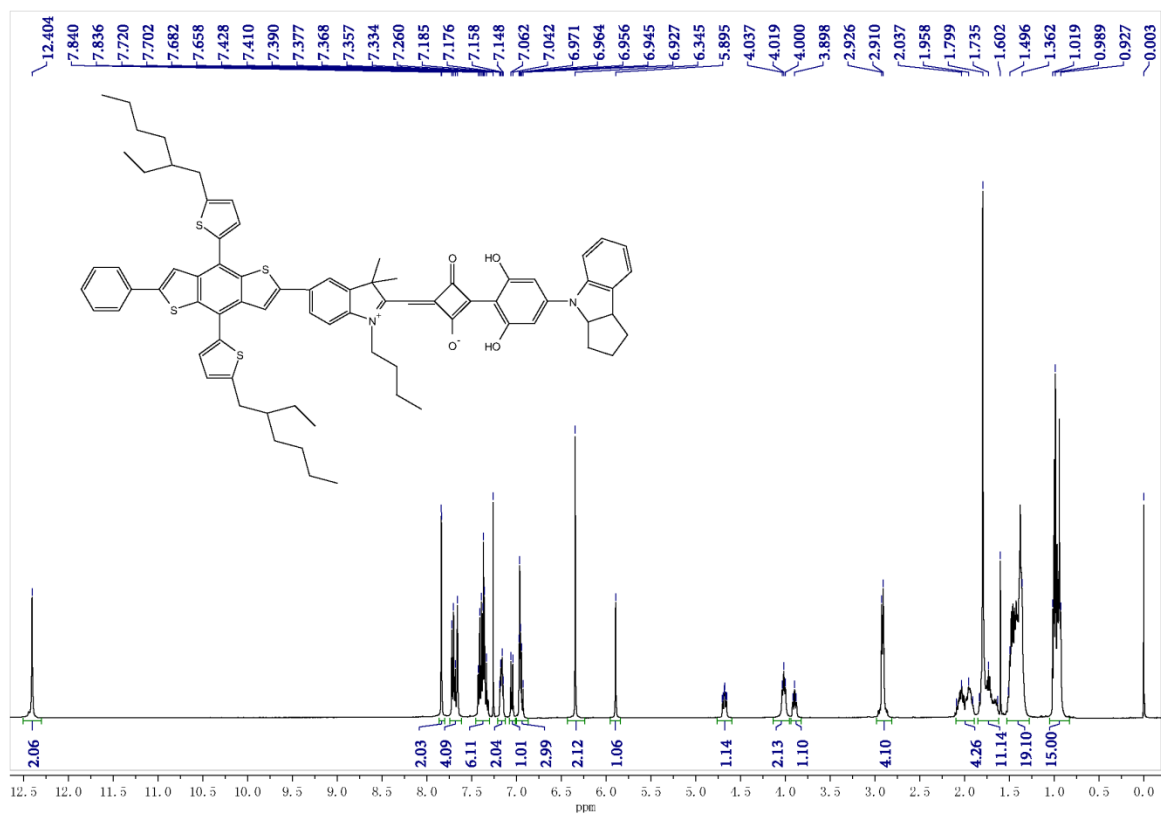


Fig. S6 ^1H NMR spectra of BDT-SQ

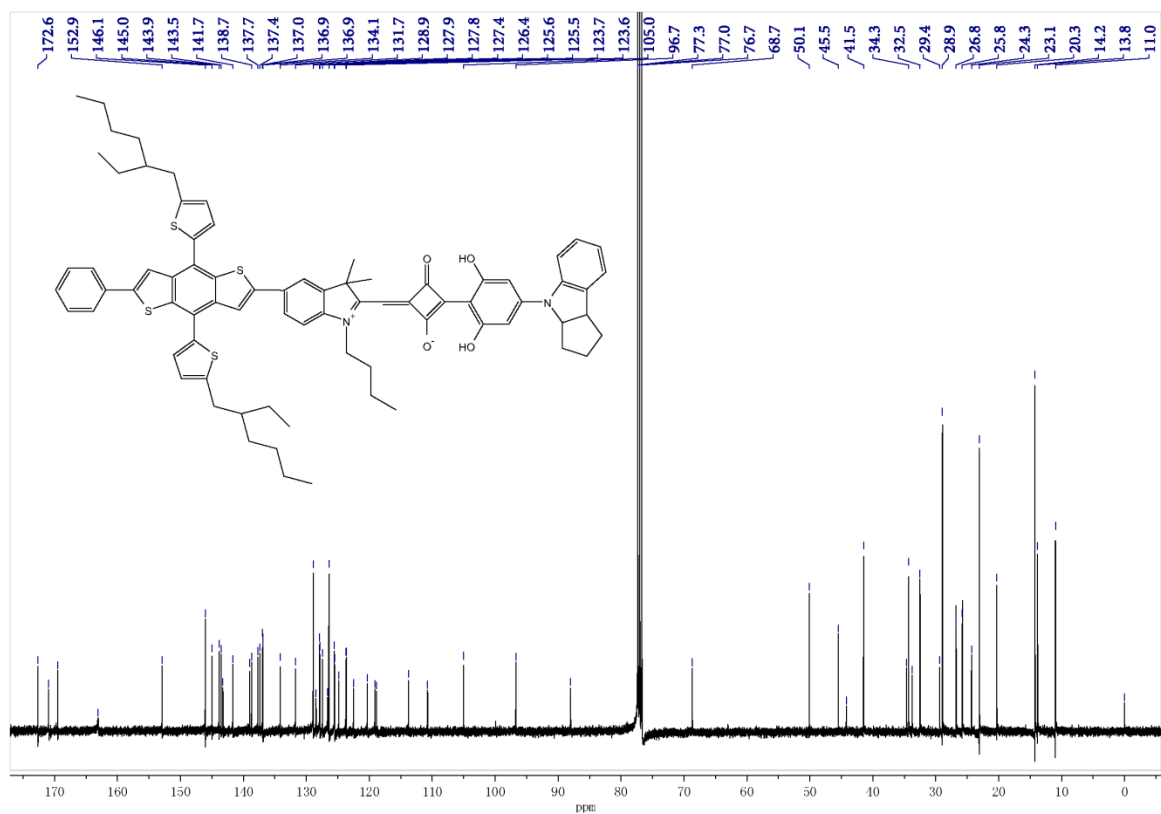


Fig. S7 ^{13}C NMR spectra of BDT-SQ

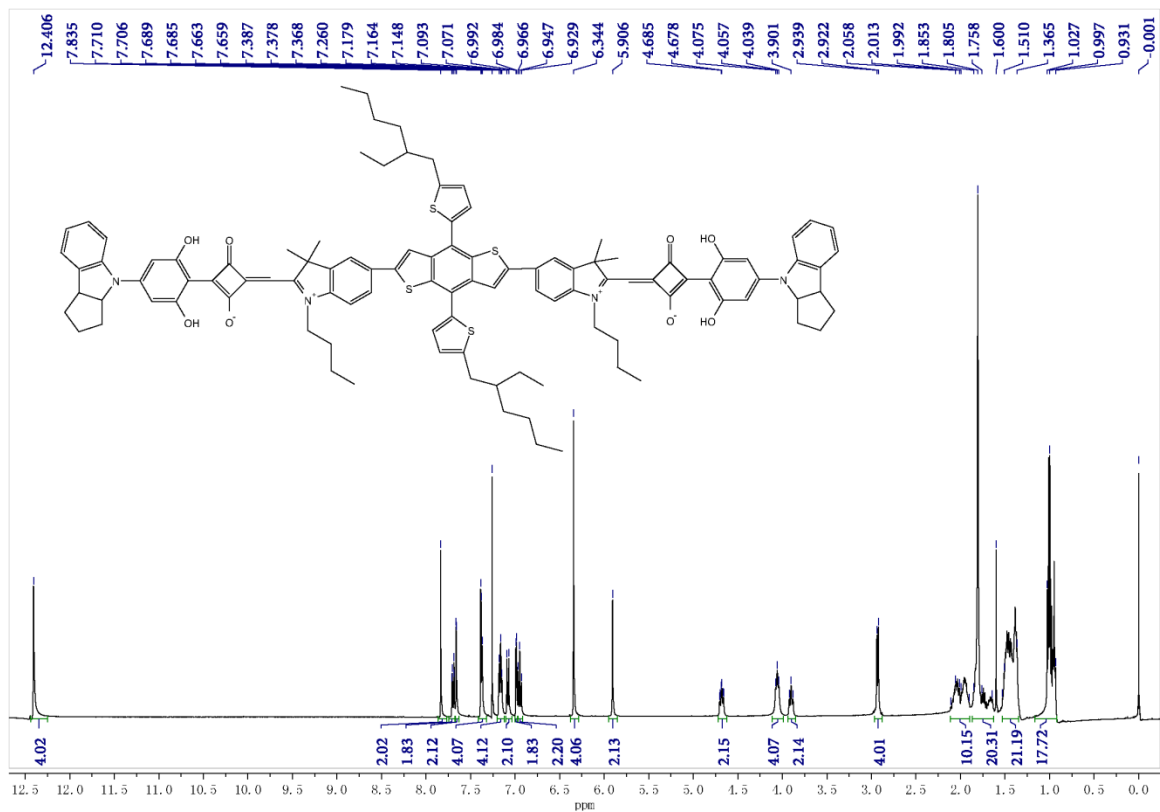


Fig. S8 ^1H NMR spectra of D-BDT-SQ

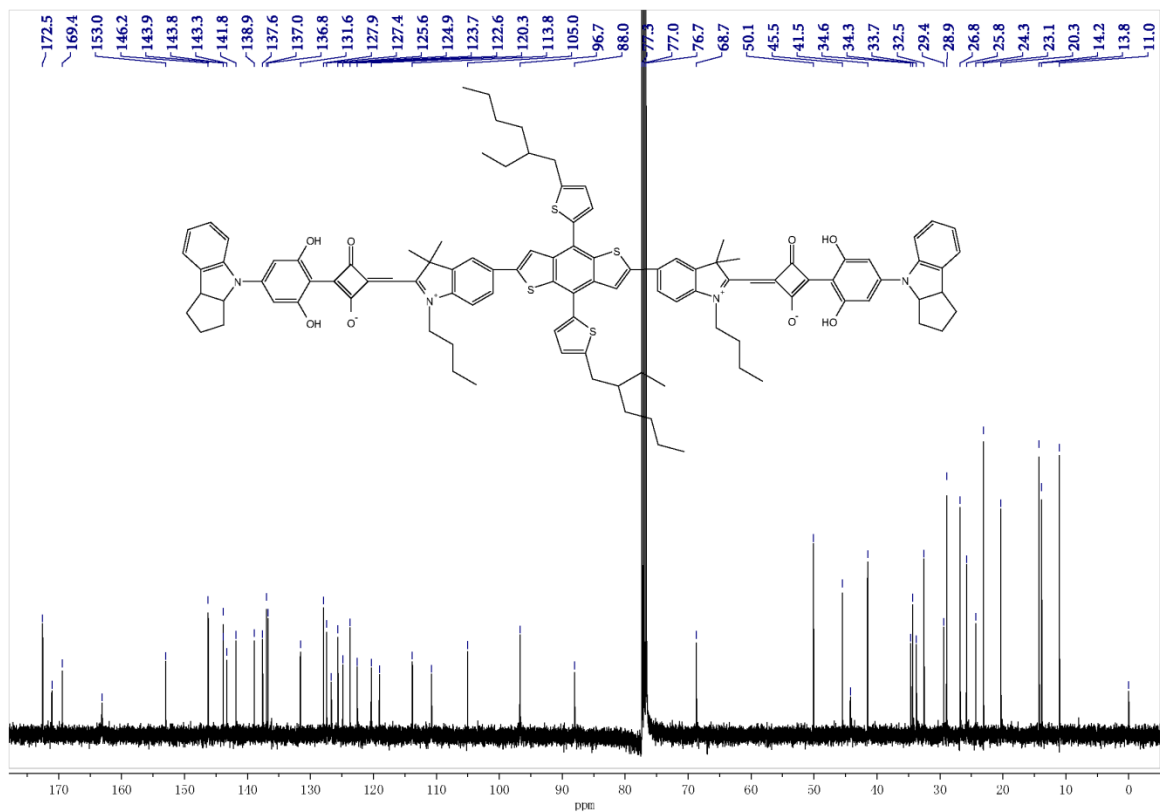


Fig. S9 ^{13}C NMR spectra of D-BDT-SQ