Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

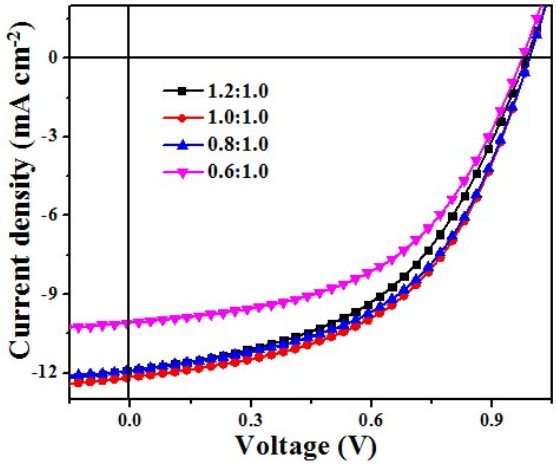


Fig. S1 The *J-V* curves of the optimal ST-PSCs with a 15 nm Ag cathode and different PBDDTT-3TC:ITIC ratios under the illumination of AM1.5G, 100 mW cm^{-2}.

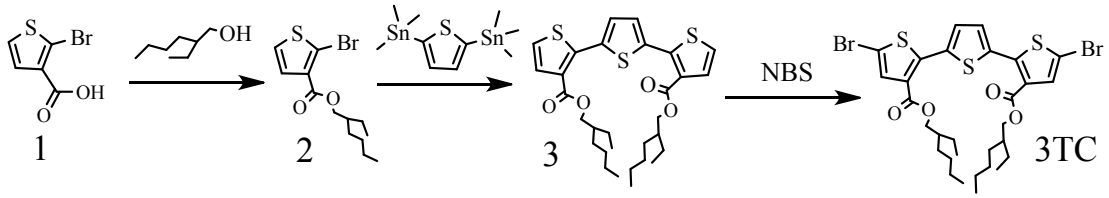
Table S1 Photovoltaic performance parameters of the ST-PSCs with a 15 nm Ag cathode and different PBDDTT-3TC:ITIC blend ratios under the illumination of AM1.5G, 100 mW cm^{-2}.

D/A ratios	V_{oc} (V)	J_{sc} (mA cm^{-2})	FF (%)	PCEmax (PCEave)[a] (%)	Active layer thickness (nm)
1.2:1.0	0.98	11.87	48.57	5.66 (5.51)	105
1.0:1.0	0.99	12.13	51.18	6.15 (6.08)	102
0.8:1.0	0.99	11.85	51.19	6.00 (5.89)	98
0.6:1.0	0.97	10.05	50.95	4.98 (4.71)	101

Table S2 Photovoltaic performance parameters of opaque PSCs based on PBDDTT-3TC:ITIC with 100 nm Ag cathode and about 100 nm in all active layer thickness under the illumination of AM1.5G, 100 mW cm-2.

D/A ratios	V_{oc} (V)	J_{sc} (mA cm^{-2})	FF (%)	PCE (%)
1.0:1.0	0.99	13.33	52.32	6.92
1.5:1.0	0.99	11.49	47.56	5.39
1.0:1.5	0.99	9.91	52.39	5.15
1.0:1.0 0.5%DIO	1.01	8.81	46.49	4.17
1.0:1.0 1.0%DIO	0.99	7.57	45.22	3.40

1.0:1.0 TA (90℃,5 min)	**0.99**	**10.89**	**55.12**	**5.99**
1.0:1.0 TA (90℃,10 min)	**1.00**	**10.57**	**60.07**	**6.37**



The monomers (2 and 3) were prepared based on a previously reported method.[1]

5,5’’- dibromo-3,3’’- dicarboxylic acid ethylhexyl ester - 2,2’:5’,2’’- terthiophene (3TC). In a 50 mL two-neck roundbottom flask, compound 3 (1.24 g, 2.20 mmol) and N-Bromosuccinimide (NBS) (1.178 g, 6.62 mmol) were mixed in 30 mL of chloroform. The solution was stirred overnight in the dark at room temperature. The solution was washed with water, and extracted using dichloromethane and was then dried over anhydrous MgSO4. The organic layer was concentrated by evaporation, and the residue was purified by column chromatography on silica gel to afford product 3TC as a yellow oil (yield 85%).

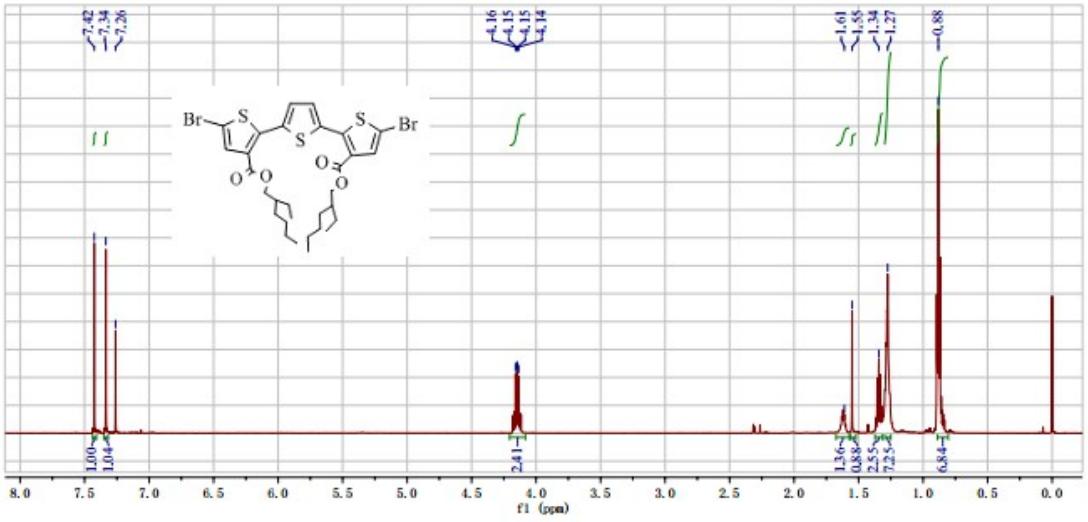


Fig. S2 [1]HNMR spectrum of compound 3TC.

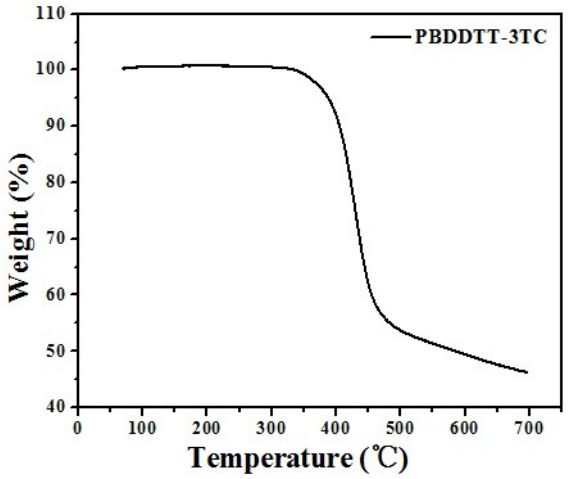


Fig. S3 TGA plot of PBDDTT-3TC with a heating rate of 10 ℃/min under nitrogen.

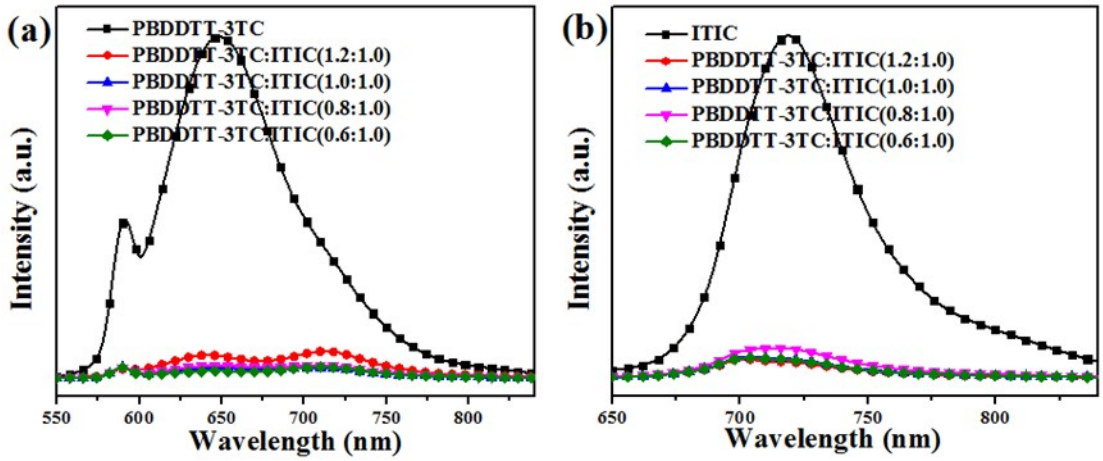


Fig. S4 photoluminescence spectra of the PBDDTT-3TC and ITIC and PBDDTT-3TC:ITIC blend films with different D/A ratios.

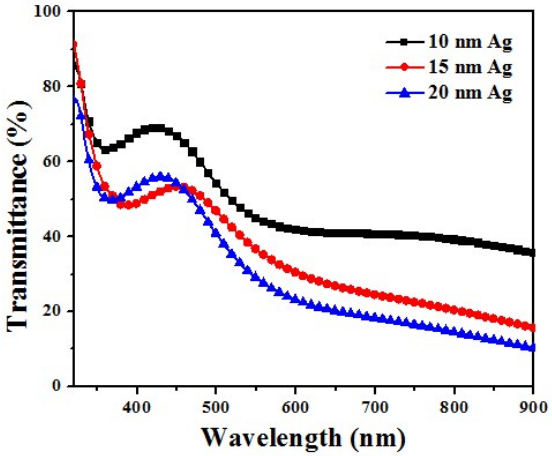


Fig. S5 Transmission spectra of Ag thin films with different thickness.

Fig. S6 photos of the semitransparent device with 15 nm Ag cathode.

Reference

1. D. Liu, B. Yang, B. Jang, B. Xu, S. Zhang, C. He, H. Y. Woo and J. Hou, Energy Environ. Sci., 2017, 10, 546-551.