Electronic Supplementary Information

Tunable Light Harvesting Properties of a Highly Crystalline Alternating Terpolymer for High–Performing Solar Cells

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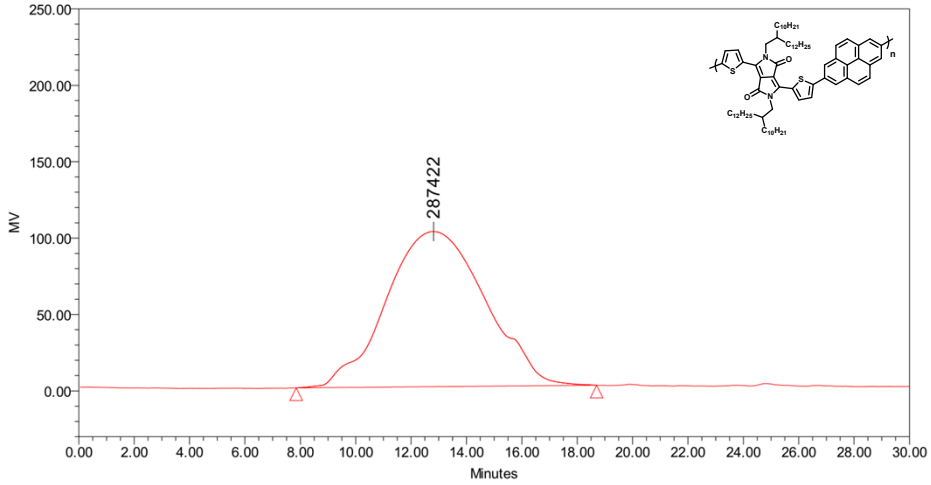
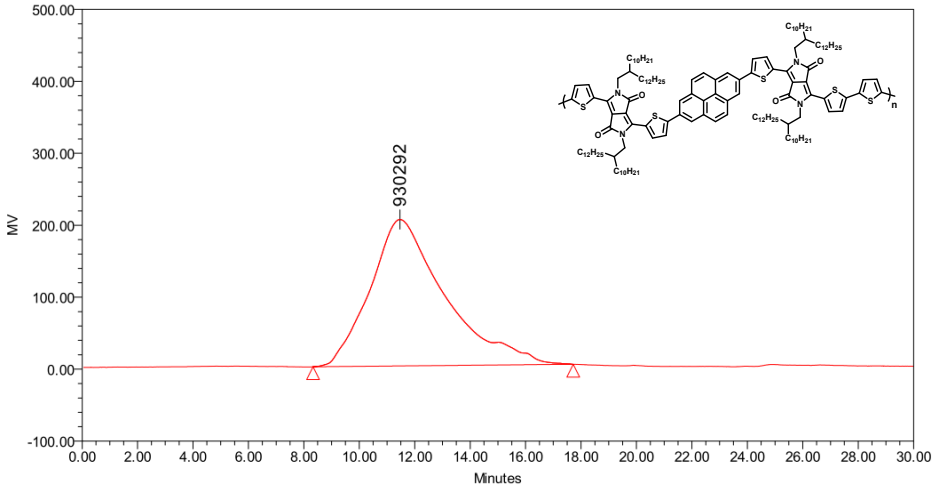
KEYWORDS conjugated copolymer, terpolymer, thin film transistors, organic photovoltaics

Gel Permeation Chromatograms



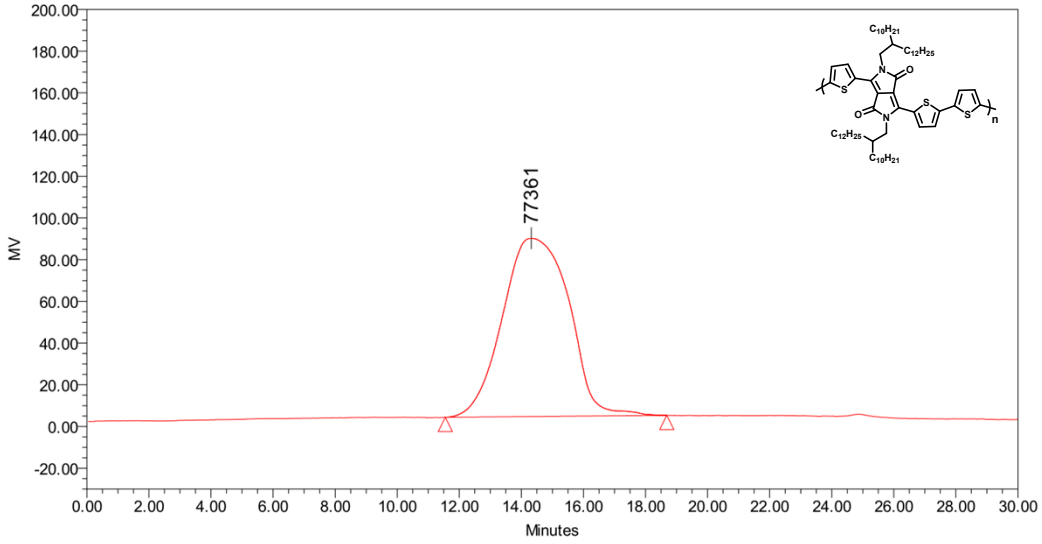
M_n (Da)	M_w (Da)	M_P (Da)	M_z (Da)	Polydispersity	% Area
94798	626553	287422	2586645	6.609313	100.00

Fig. S1 GPC chromatogram of PDPPPy.



M_n (Da)	M_w (Da)	M_P (Da)	M_z (Da)	Polydispersity	% Area
197790	1095020	930292	2557106	5.536283	100.00

Fig. S2 GPC chromatogram of PDPPPyT.



M_n (Da)	M_w (Da)	M_P (Da)	M_z (Da)	Polydispersity	% Area
46558	90056	77361	155962	1.934260	100.00

Fig. S3 GPC chromatogram of PDPPT.

Thermal analysis

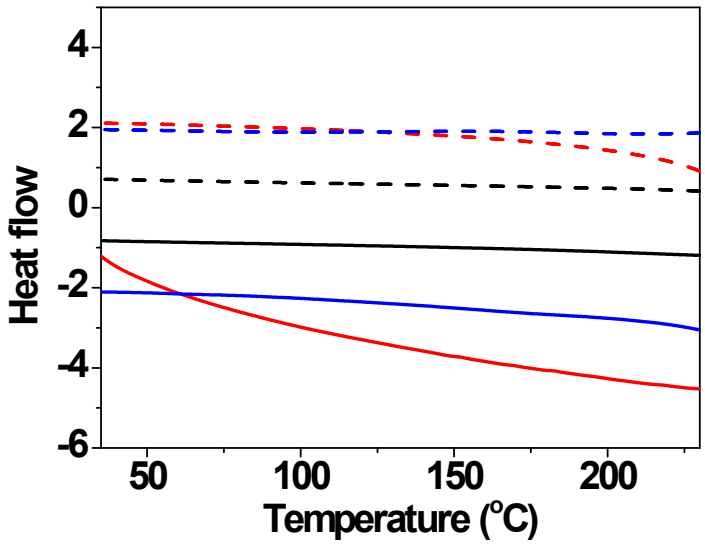


Fig. S4 DSC thermograms of PDPPPy (black), PDPPPyT (red), and PDPPT (blue). Heating cycle (solid line) and cooling cycle (dashed line).

GI-XRD Data

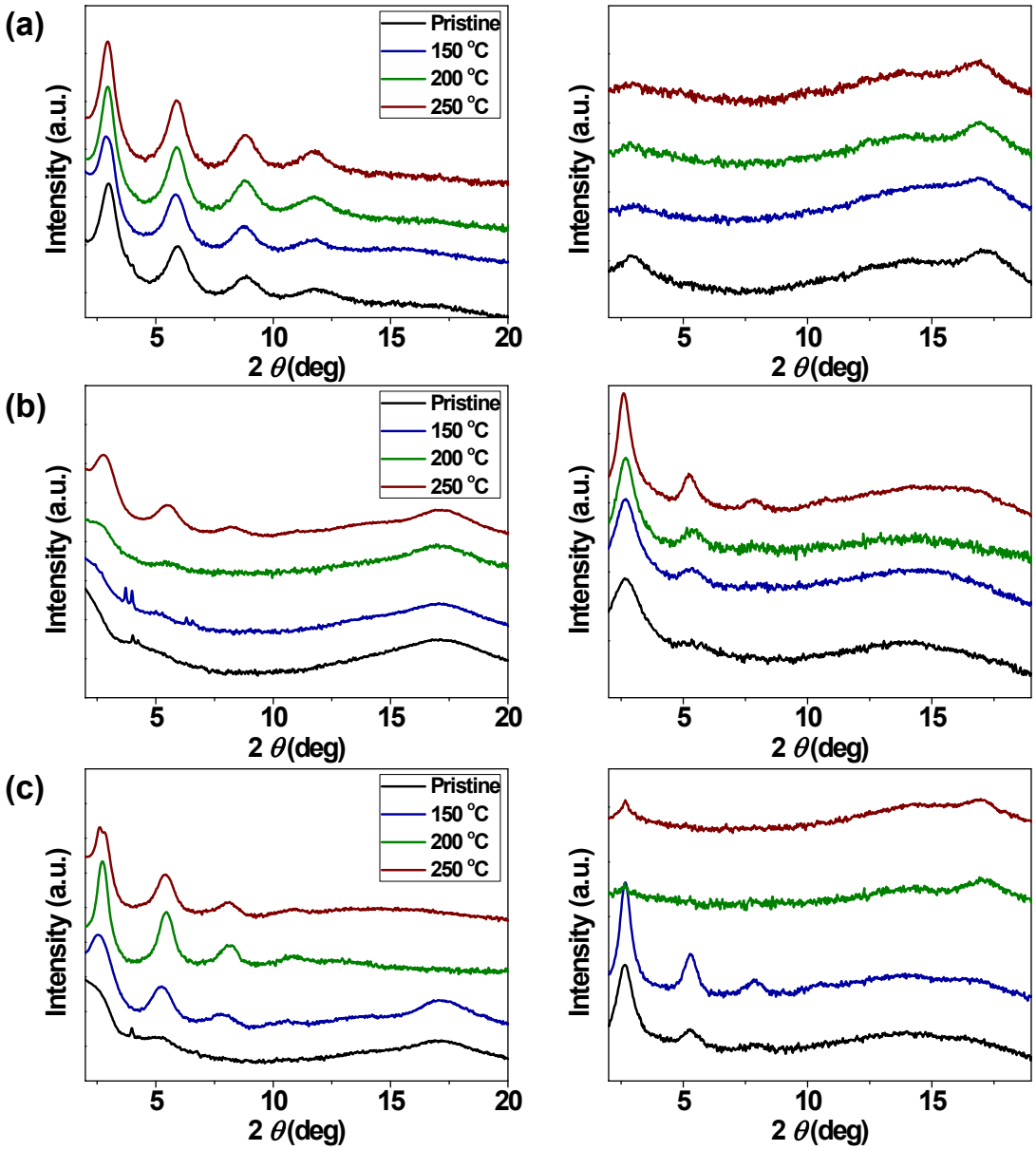


Fig. S5 Out-of-plane and in-plane profiles of XRD patterns. Sample: thermally annealed films of (a) PDPPPy, (b) PDPPPyT and (c) PDPPT. Out-of-plane (left side) and in-plane (right side).

Table S1 Crystallographic parameters calculated from the GI-XRD profiles of PDPPPy.

Crystallographic parameters		**Annealing Temperature**			
		Pristine	**150 °C**	**200 °C**	**250 °C**
Out-of-plane (100)	q_z (Å^{-1})	0.2808	0.2686	0.2754	0.2764
	d-spacing (Å)	21.43	22.29	21.73	21.76
	FWHM (Å^{-1})	0.0351	0.0467	0.0315	0.0309
In-plane (100)	q_z (Å^{-1})	0.2810	0.2926	0.2829	0.2887
	d-spacing (Å)	22.36	20.14	22.21	21.76
	FWHM (Å^{-1})	-	-	-	-

Table S2 Crystallographic parameters calculated from the GI-XRD profiles of PDPPPyT.

Crystallographic parameters		**Annealing Temperature**			
		Pristine	**150 °C**	**200 °C**	**250 °C**
Out-of-plane (100)	q_z (Å^{-1})	-	-	-	0.2585
	d-spacing (Å)	-	-	-	23.41
	FWHM (Å^{-1})	-	-	-	0.0740
In-plane (100)	q_z (Å^{-1})	0.2596	0.2635	0.2635	0.2557
	d-spacing (Å)	24.20	23.85	z23.85	24.57
	FWHM (Å^{-1})	0.1022	0.0712	0.0507	0.0338

Table S3 Crystallographic parameters calculated from the GI-XRD profiles of PDPPT.

Crystallographic parameters		**Annealing Temperature**			
		Pristine	**150 °C**	**200 °C**	**250 °C**
Out-of-plane (100)	q_z (Å^{-1})	-	0.2347	0.2560	0.2414
	d-spacing (Å)	-	25.49	23.46	25.49
	FWHM (Å^{-1})	-	0.0619	0.0245	0.0407
In-plane (100)	q_z (Å^{-1})	0.2635	0.2616	0.2577	0.2616
	d-spacing (Å)	23.39	24.02	24.39	24.02
	FWHM (Å^{-1})	0.0437	0.0245	-	-

Output curves of the TFTs

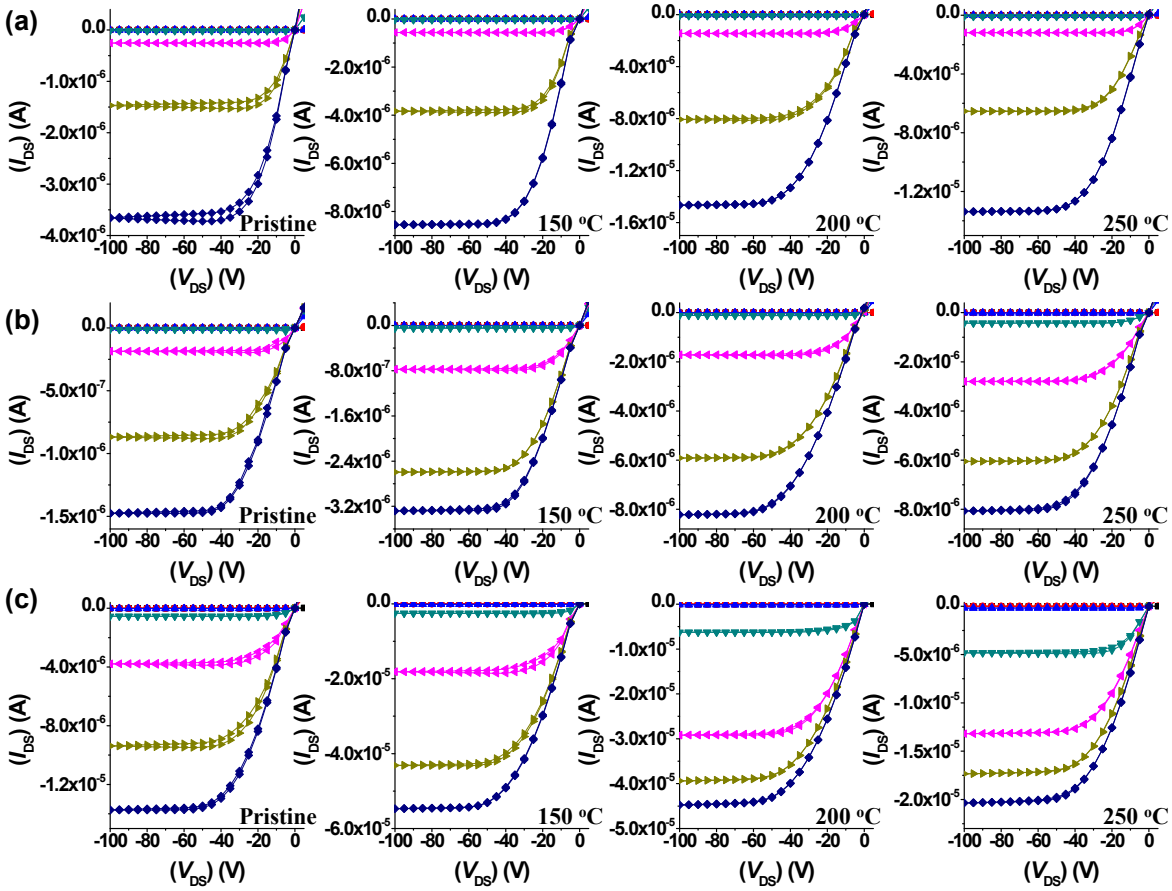


Fig. S6 Output curves of (a) PDPPPy, (b) PDPPPyT, and (c) PDPPT TFTs. The range of the output curves is −40 to 20 V and V_{DS} = −100 V.

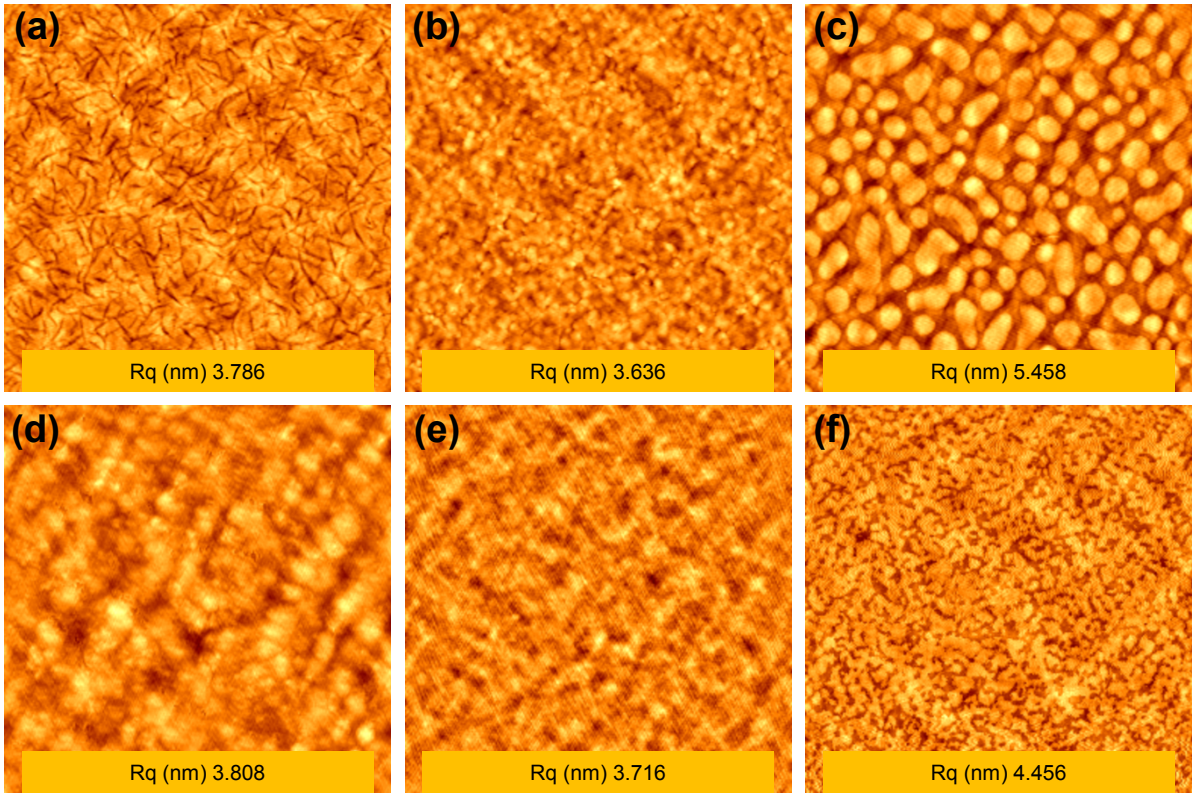


Fig. S7. AFM images (size: 10 μm X 10 μm) of photoactive layers. PDPPPy (a, d), PDPPPyT (b, e), and PDPPT (c, f). (a, b, c): the images obtained without DIO and (d, e, f): the images obtained with 3 vol% DIO.

The surface morphology of the active PSC layer was measured by AFM for better understanding the basis for the improved performance observed by adding DIO additives. As shown in Fig. S7, the surface morphology was observed to be different by adding 3 vol% DIO into the photoactive layers.