Supporting Information

Intrinsically Stretchable Naphthalenediimide–Bithiophene Conjugated Statistical Terpolymers Using Branched Conjugation Break Spacers for Field–Effect Transistors

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[†]Y.C. L. and M. M. equally contributed to this study as the co-1st authors.

KEYWORDS. N-type conjugated polymer; conjugation break spacer; intrinsic stretchability; statistical terpolymers; field-effect transistor

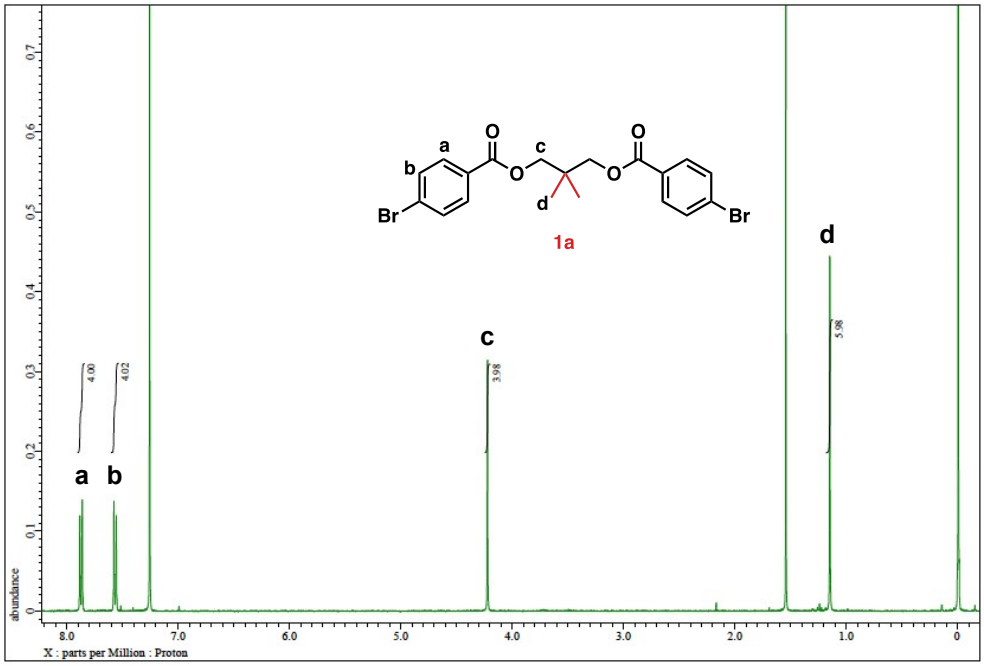

Fig. S1. ^{1}H NMR spectrum of **1a**.

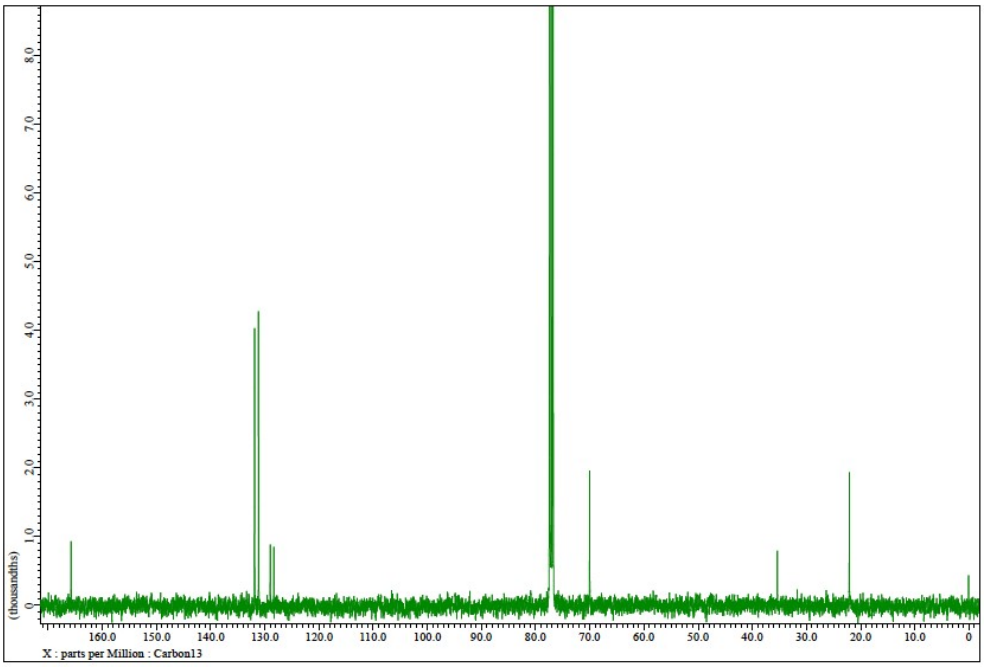

Fig. S2. ^{13}C NMR spectrum of **1a**.

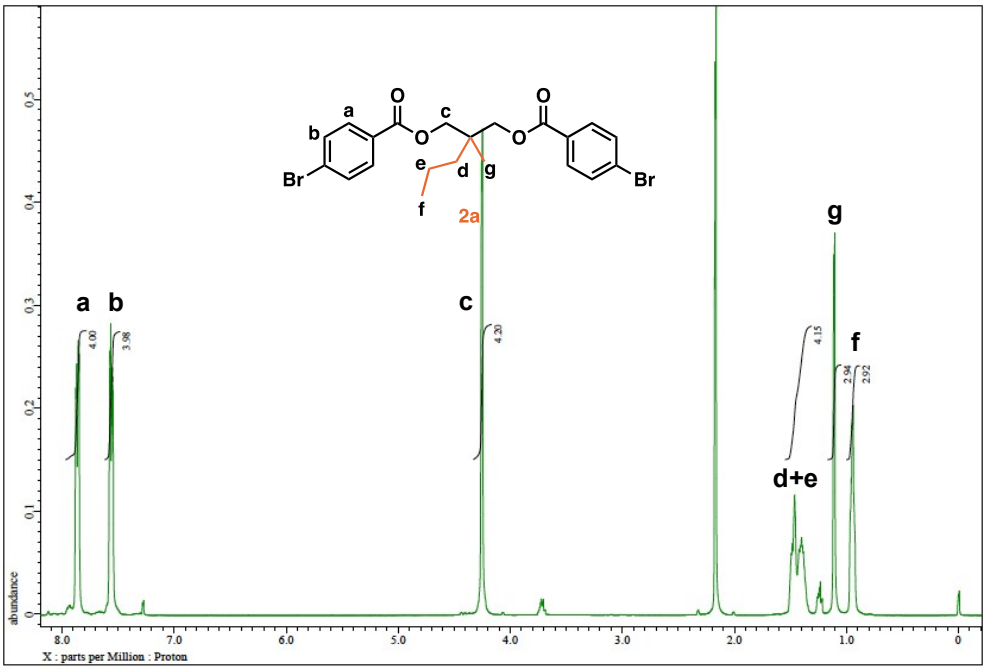

Fig. S3. ^{1}H NMR spectrum of **2a**.

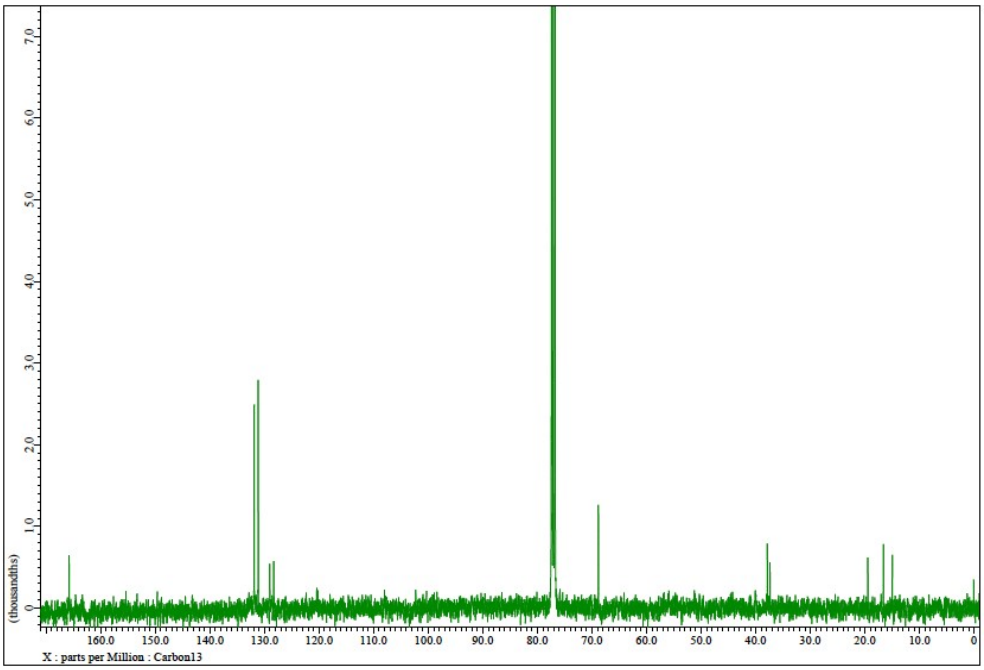

Fig. S4. ^{13}C NMR spectrum of **2a**.

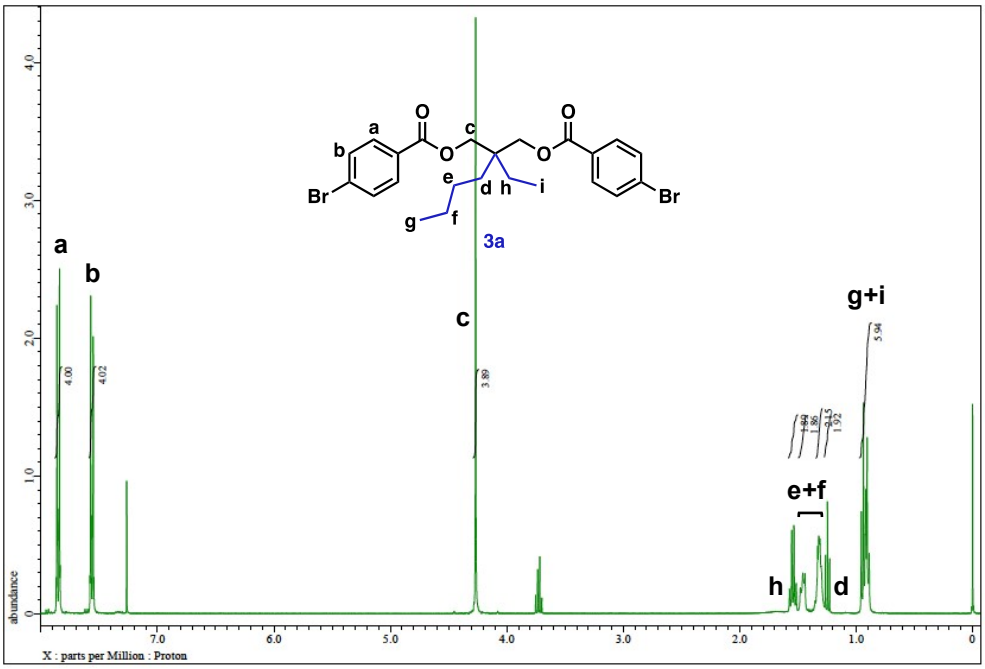

Fig. S5. ^{1}H NMR spectrum of **3a**.

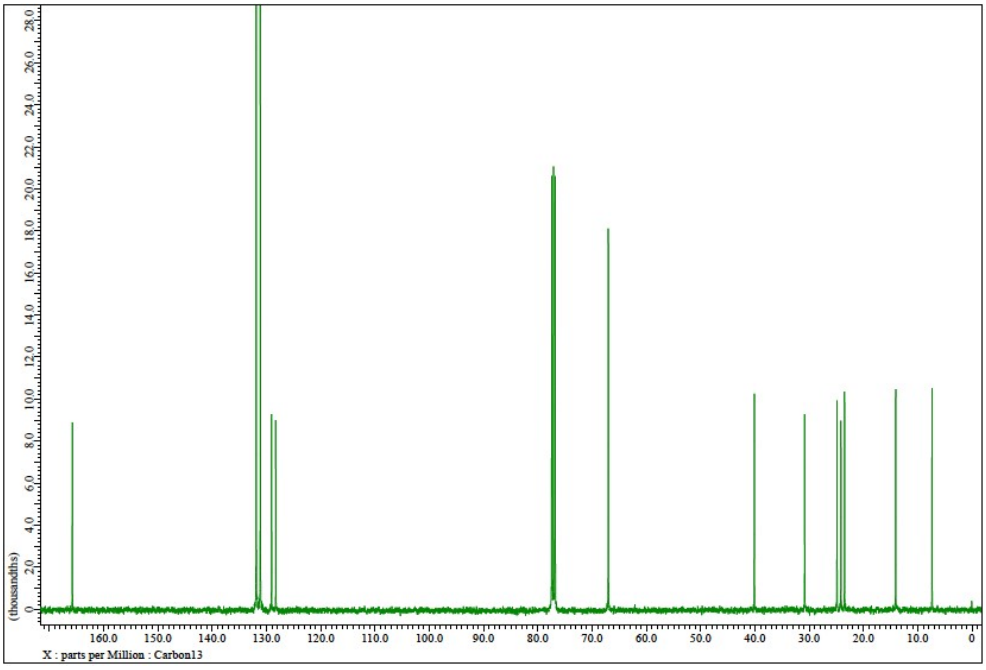

Fig. S6. ^{13}C NMR spectrum of **3a**.

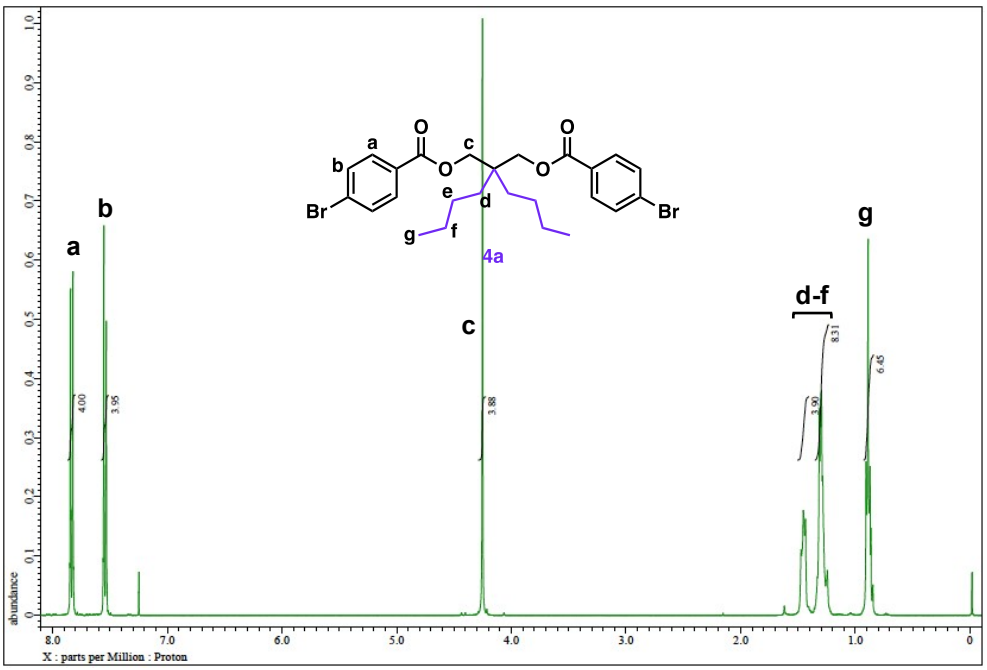

Fig. S7. ^{1}H NMR spectrum of **4a**.

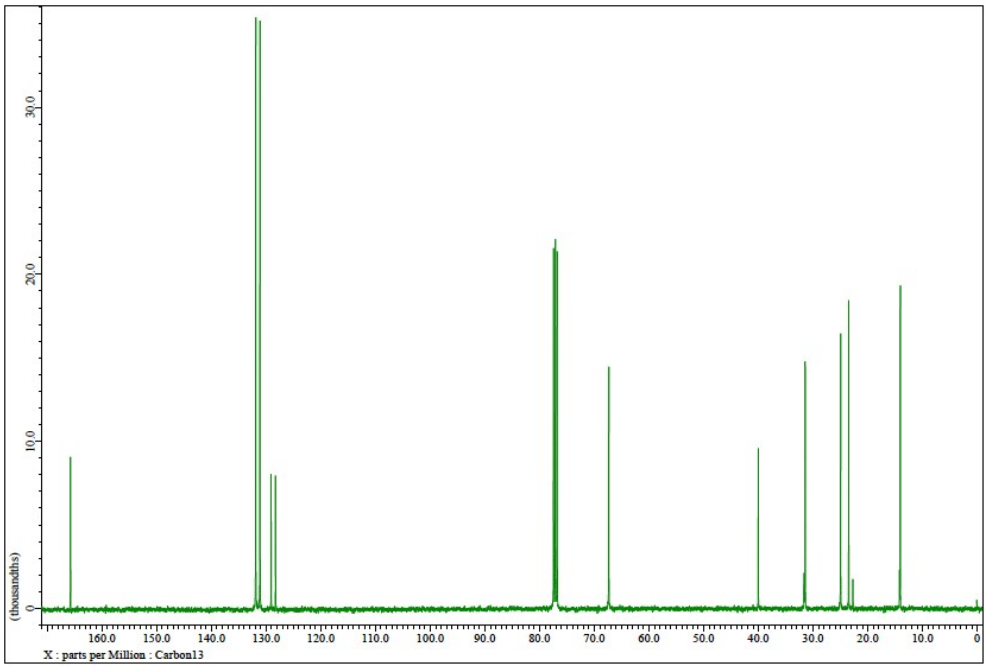

Fig. S8. ^{13}C NMR spectrum of **4a**.

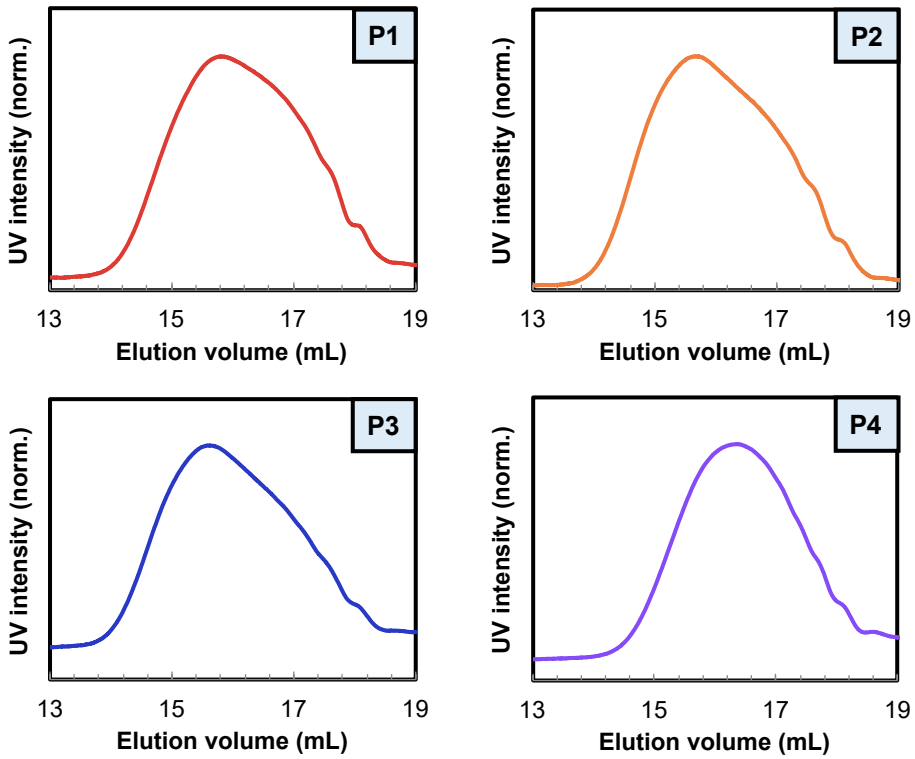

Fig. S9. SEC UV traces of polymers studied.

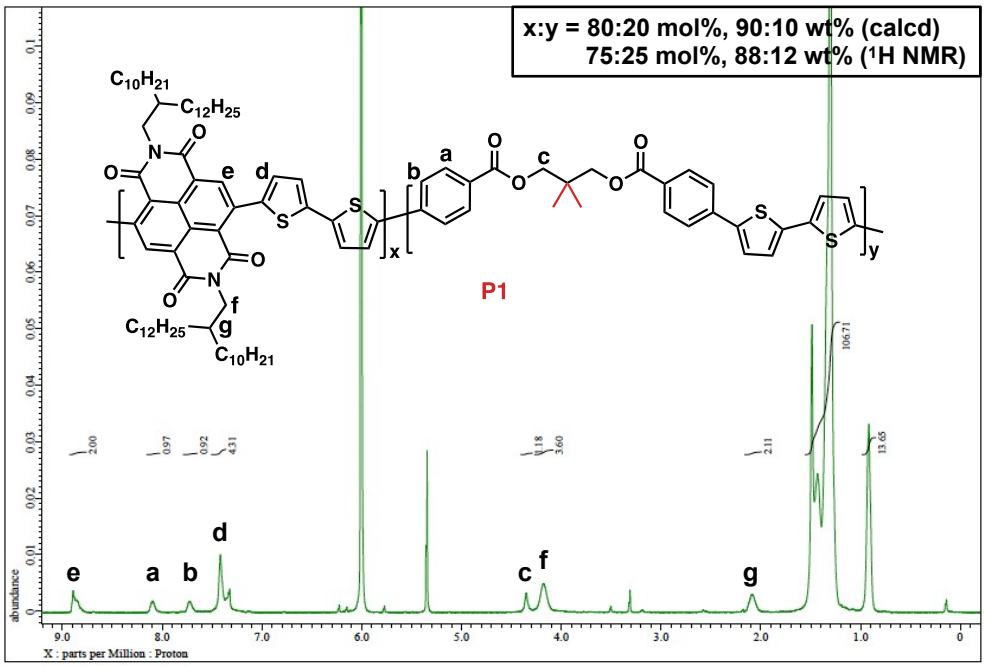

Fig. S10. ^{1}H NMR spectrum of **P1**.

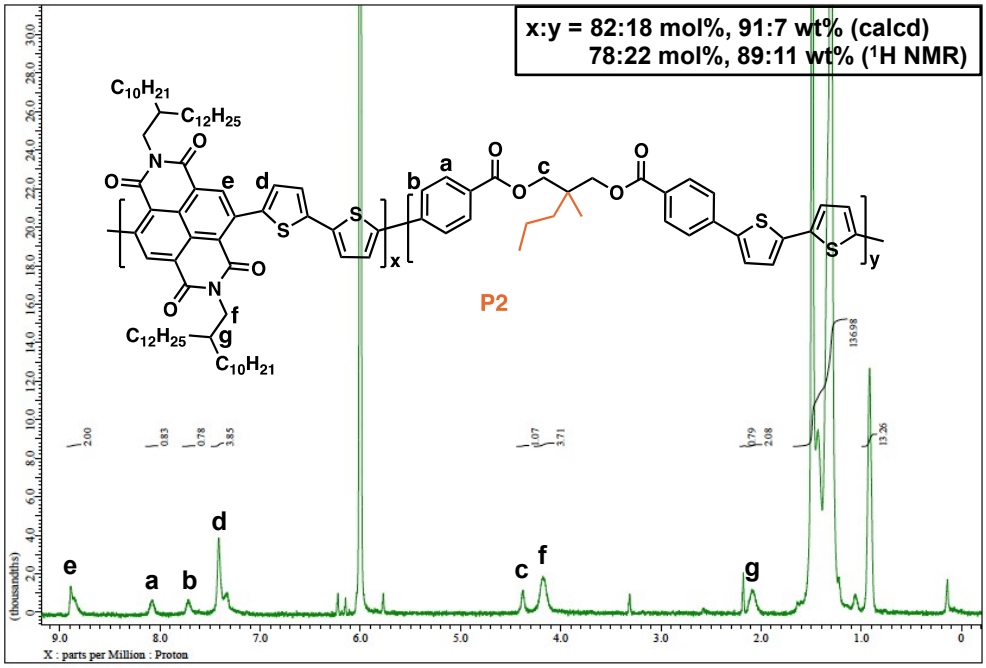

Fig. S11. ^{1}H NMR spectrum of **P2**.

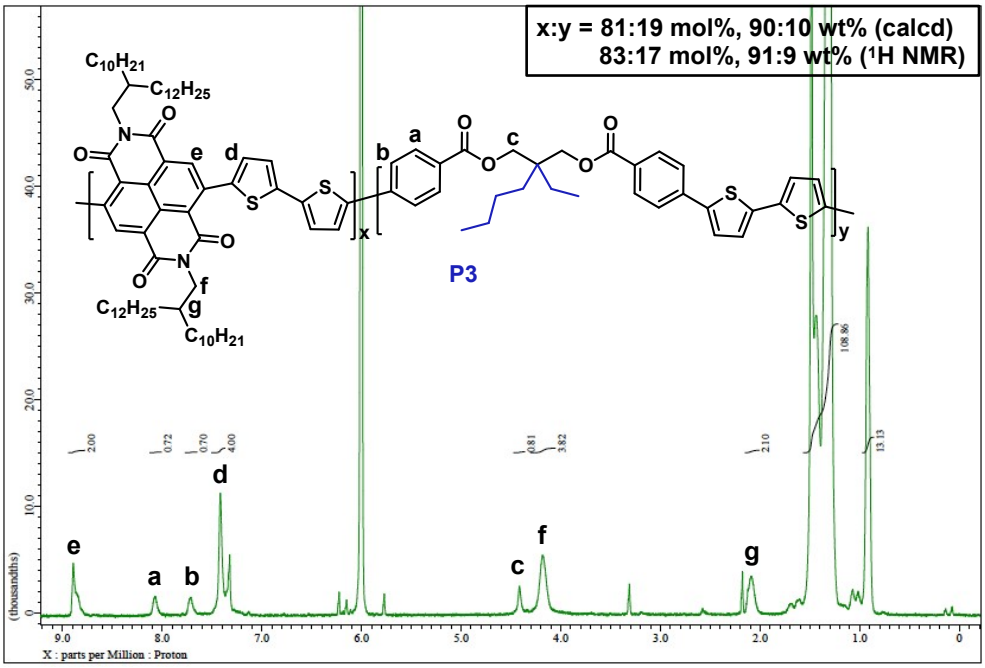

Fig. S12. ^{1}H NMR spectrum of **P3**.

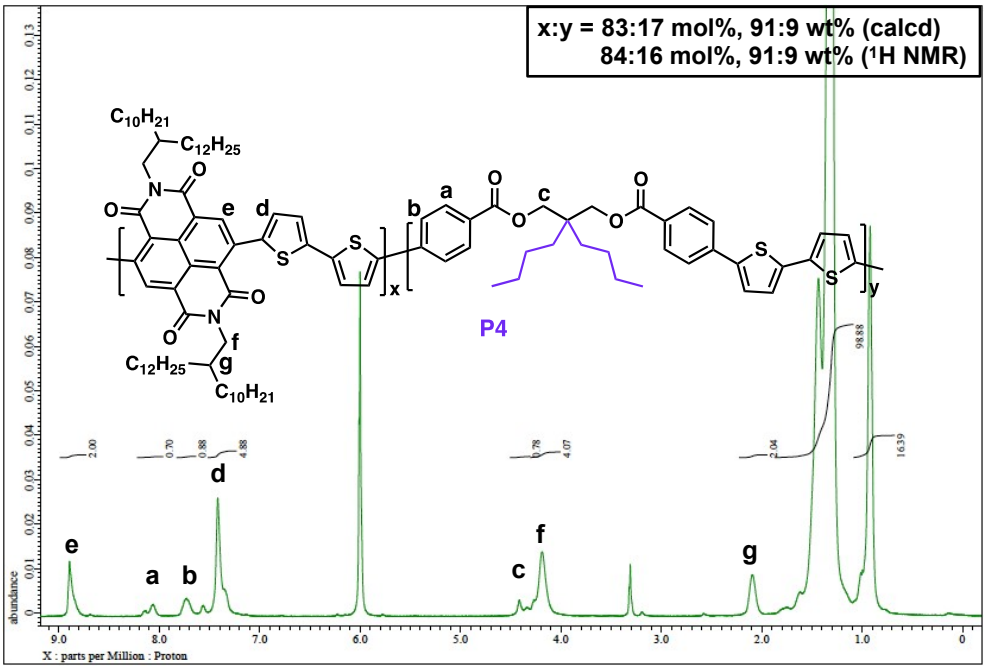

Fig. S13. ^{1}H NMR spectrum of **P4**.

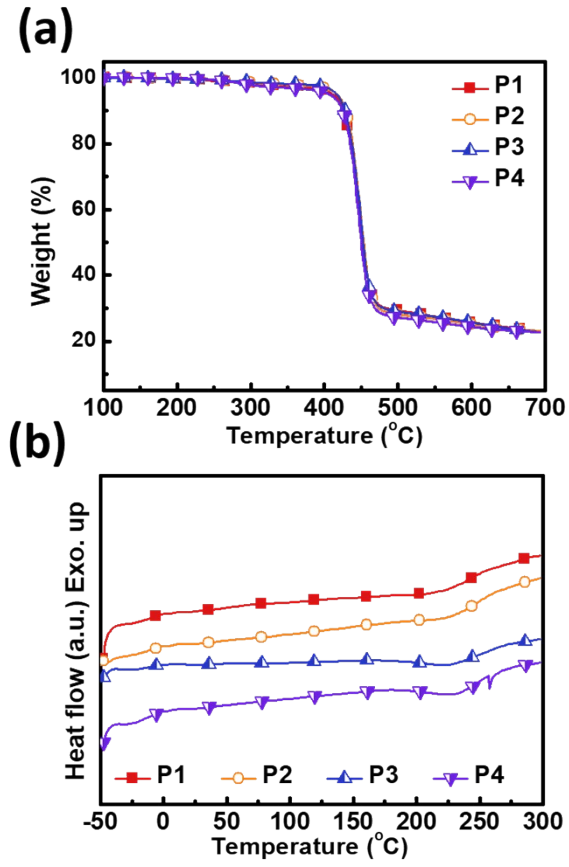

Fig. S14. (a) TGA and (b) DSC thermal histograms of the polymers studied.

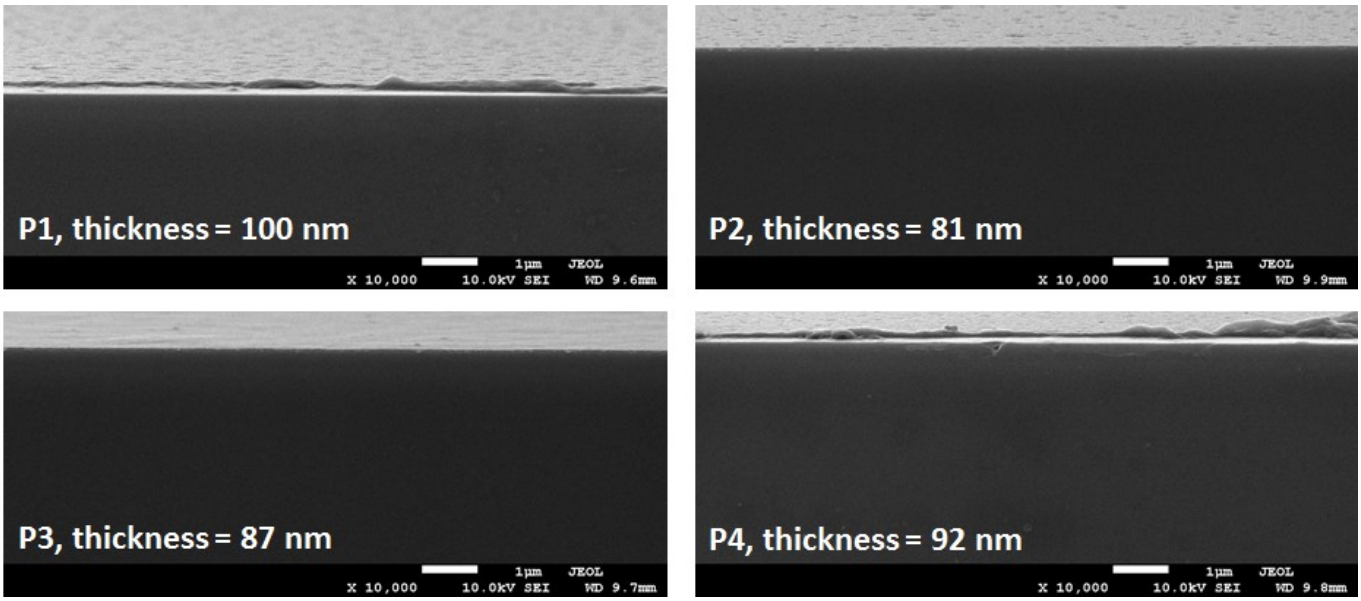

Fig. S15. Cross-sectional SEM images of the thermally annealed polymer films on silicon wafers with 300-nm-thick SiO_2 and ODTS self-assembled monolayers on the surface.

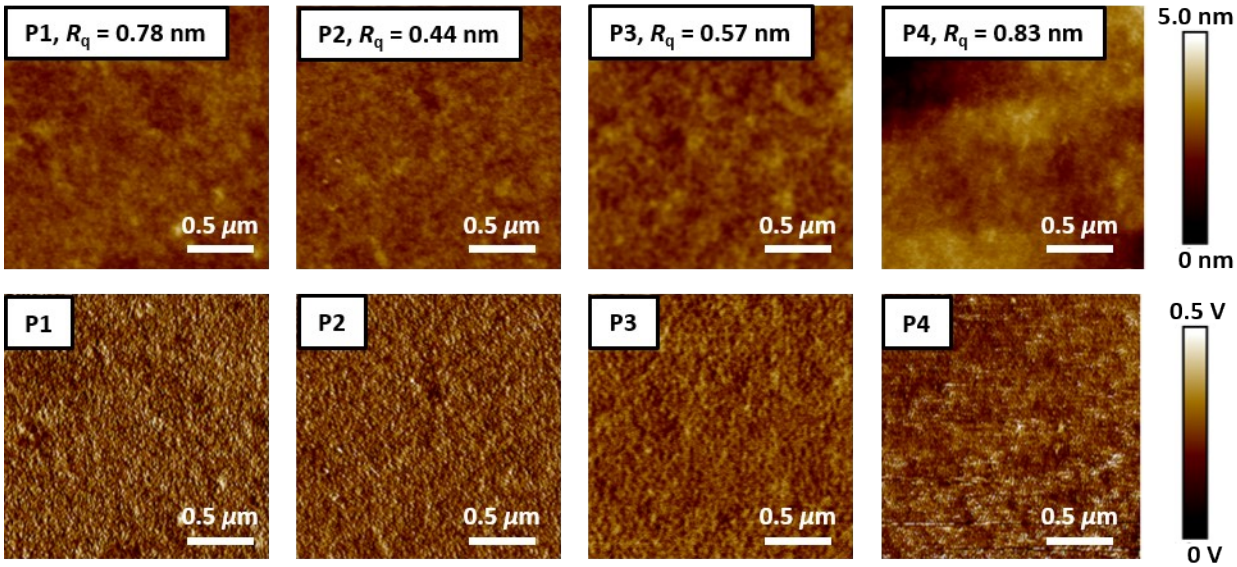

Fig. S16. AFM height/phase images of the as-cast polymer films.

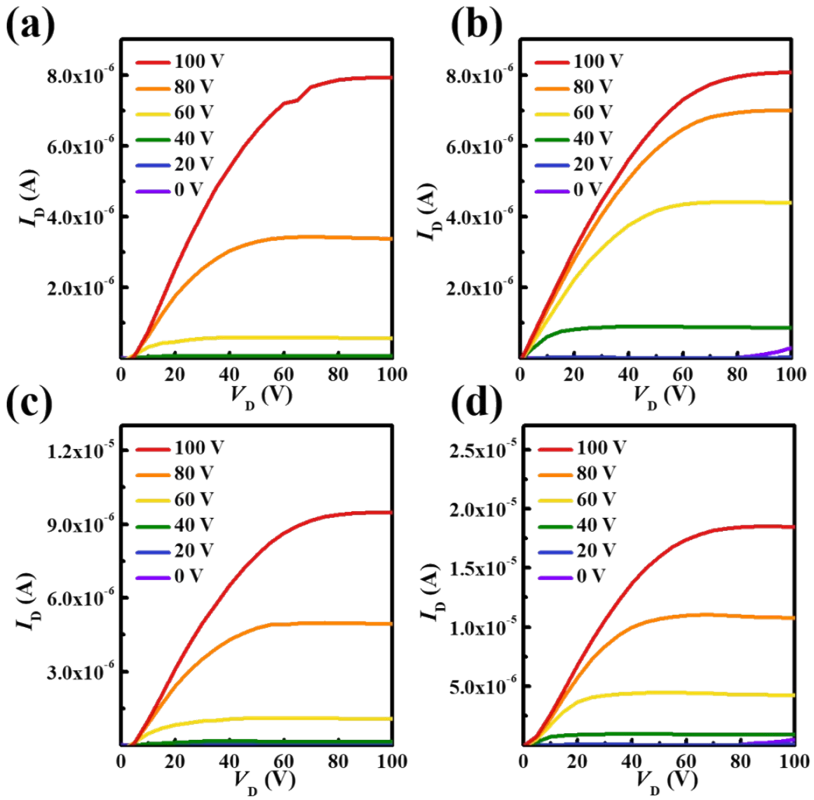

Fig. S17. FET output characteristics of the devices with the polymer films of (a) **P1** (b) **P2** (c) **P3** and (d) **P4**.

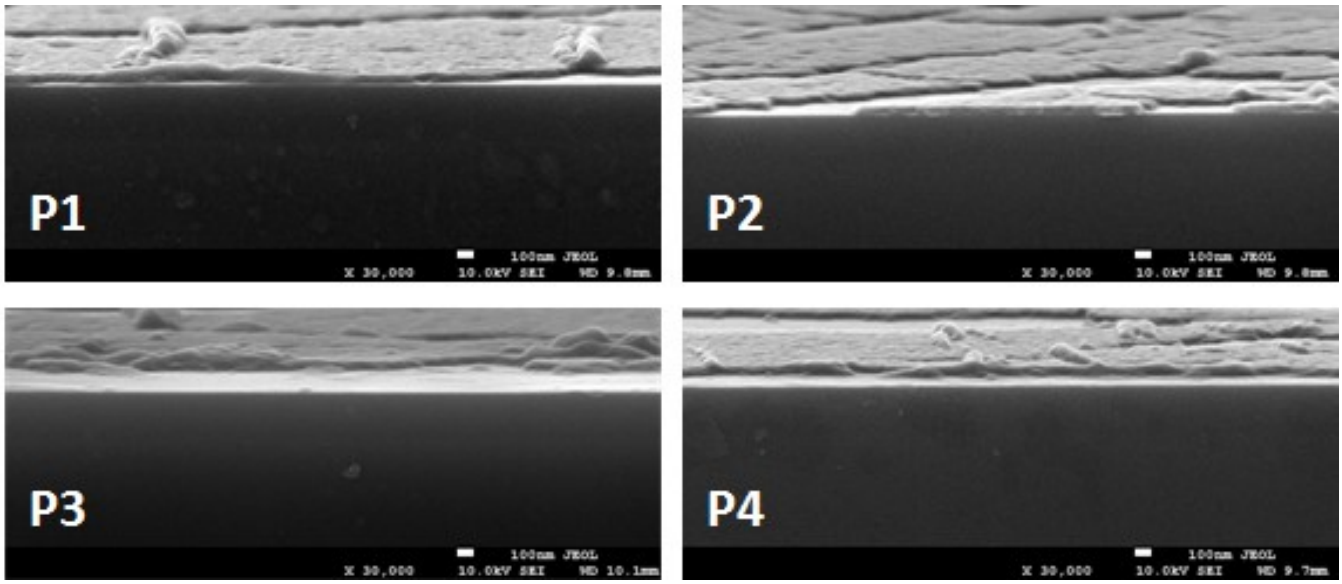

Fig. S18. Cross-sectional SEM images of the transferred/stretched polymer films at 60% strain on silicon wafers with 300-nm-thick SiO_2.

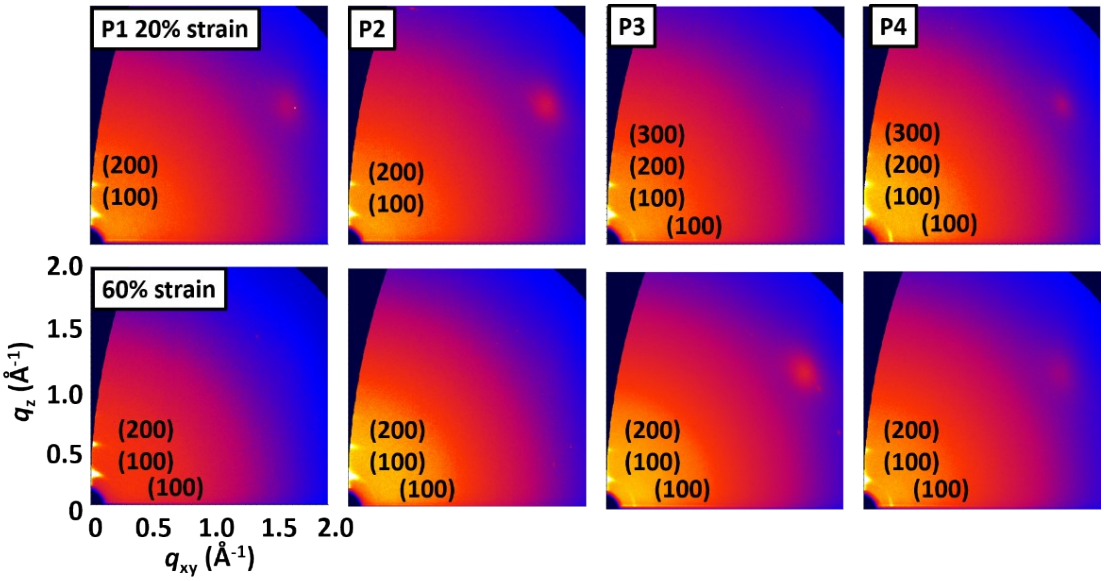

Fig. S19. 2D GIXD patterns of the transferred and stretched polymer films with stretching force perpendicualr to the incident beam.

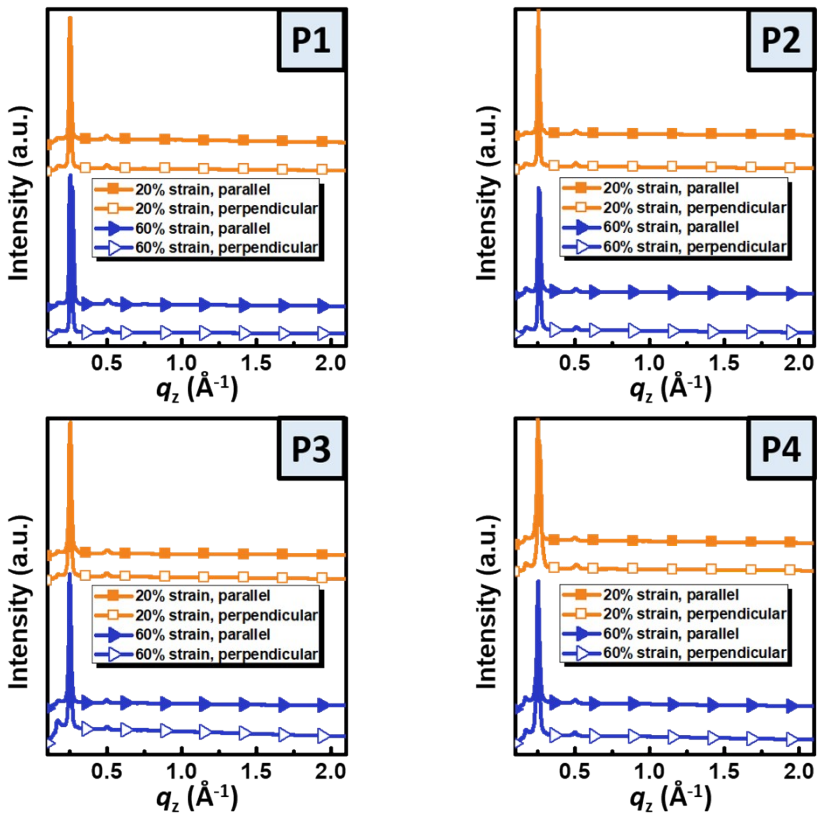

Fig. S20. 1D GIXD profiles in the OOP direction of the transferred and stretched polymer films with stretching force parallel/perpendicualr to the incident beam.

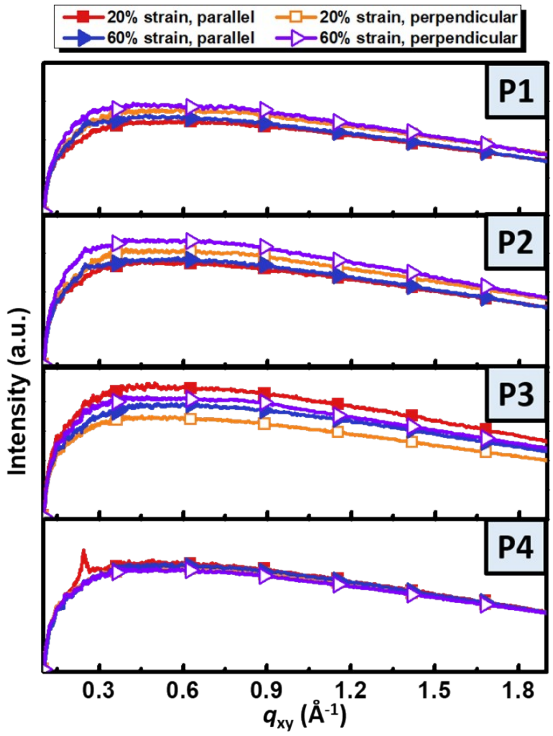

Fig. S21. 1D GIXD profiles in the IP direction of the transferred and stretched polymer films with stretching force parallel/perpendicualr to the incident beam.

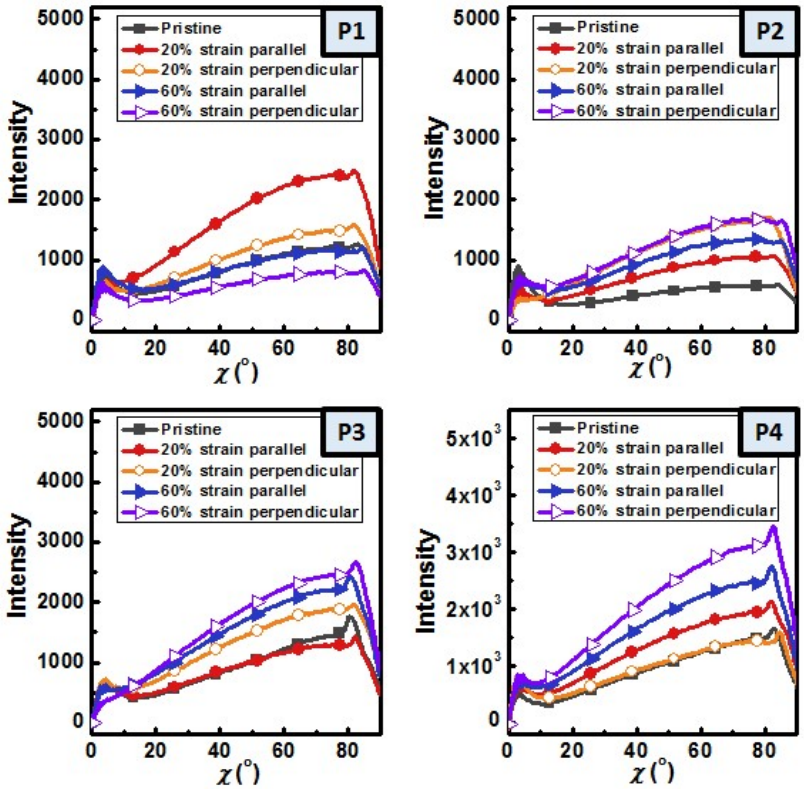

Fig. S22. Geometric corrected pole figures of the transferred and stretched polymer films for the evaluation of relative intensity of OOP and IP (100) diffractions. Note that the geometric correction was conducted by multiplying sin(χ) function.

Table S1. Relevant crystallographic parameters of the transferred and stretched polymer films. Note that the relative degree of crystallinity (rDOC) was calculated based on OOP (200) diffractions of the films.

		$d_{lamellar}$ (Å)		IP FWHM (Å^{-1})		IP(100)/OOP(100)		rDOC (%)	
Strain (%)		**20**	**60**	**20**	**60**	**20**	**60**	**20**	**60**
P1	∥	24.6	24.6	--	0.031	3.7	1.3	96	91
	⊥	24.9	24.0	--	--	2.4	1.3	93	91
P2	∥	24.6	24.6	--	0.029	2.0	1.8	75	73
	⊥	24.6	24.0	--	0.037	4.9	2.3	70	65
P3	∥	24.6	25.1	--	--	2.1	3.9	79	77
	⊥	25.1	24.6	--	--	2.7	7.0	83	74
P4	∥	25.1	24.9	--	0.020	3.0	3.6	82	72
	⊥	24.0	25.1	--	--	1.9	4.1	95	82

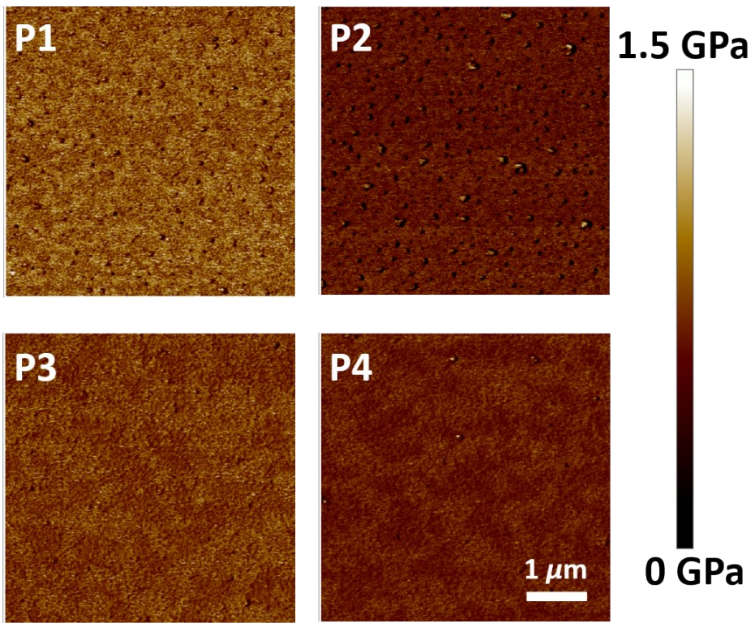

Fig. S23. AFM surface mechanical mappings and the elastic modulus evaluated from the DMT model of the polymer films.

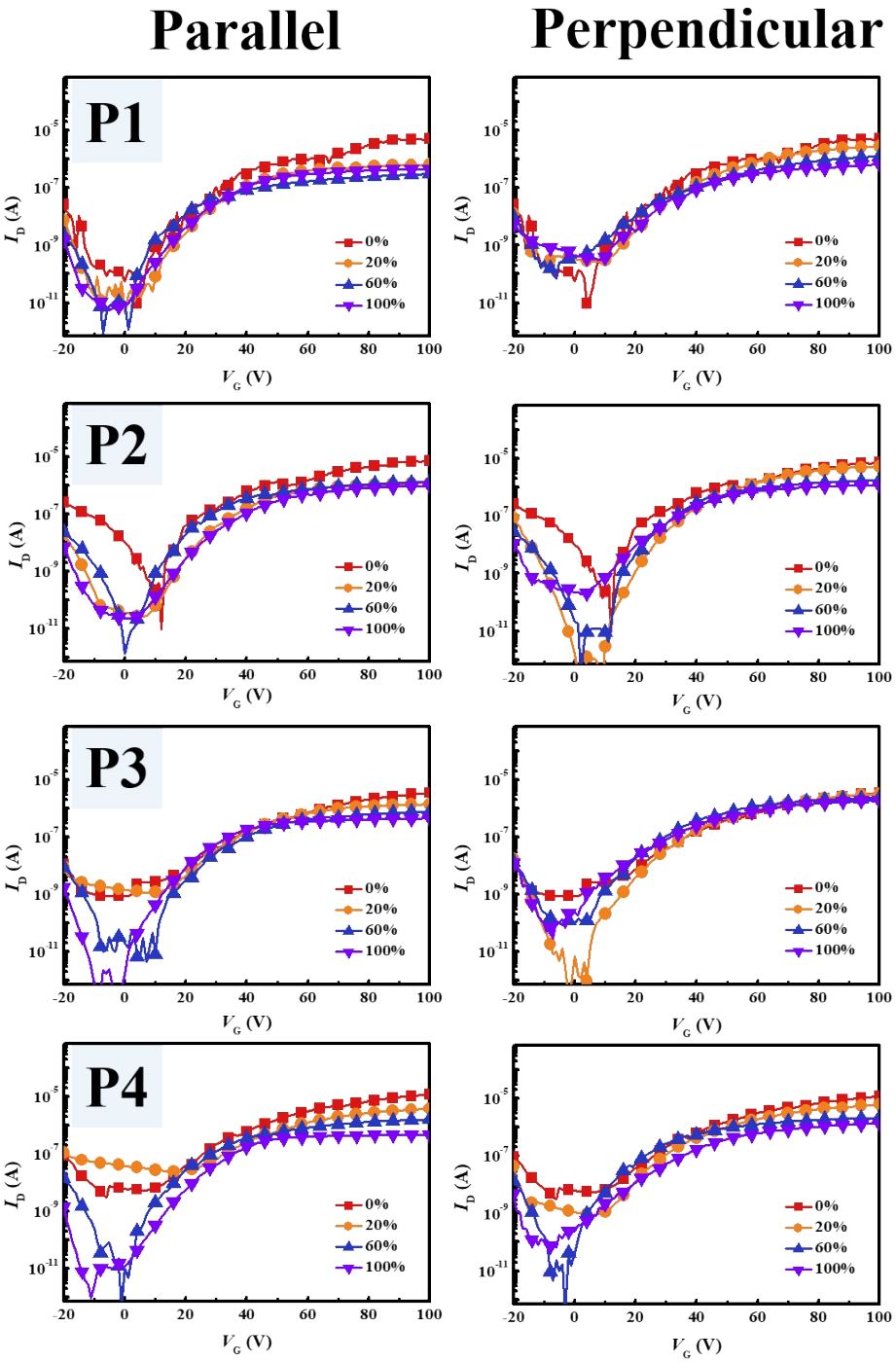

Fig. S24. FET transfer characteristics of the transferred and stretched polymer films with different stretching states parallel (left) or perpendicular (right) to the channel direction.

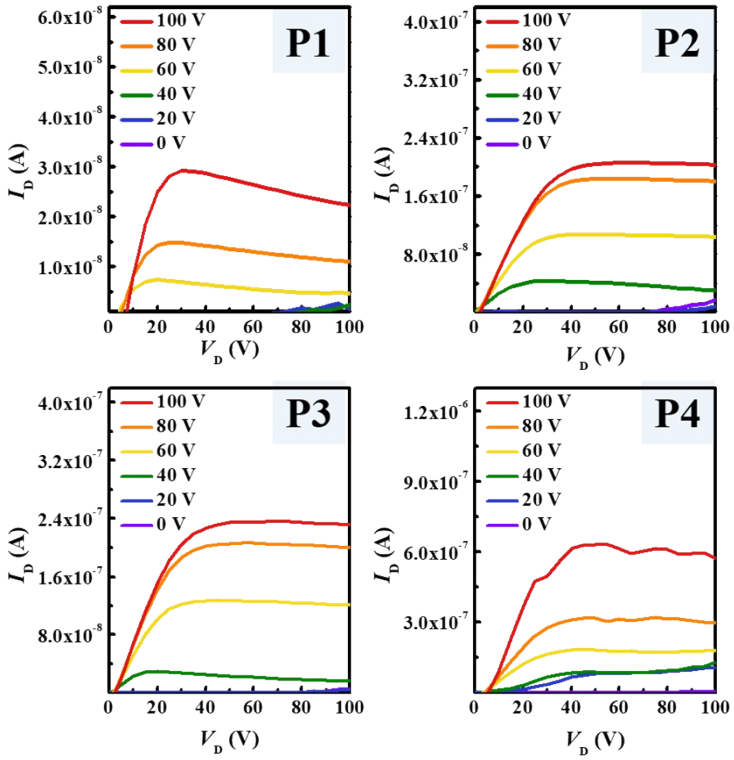

Fig. S25. FET output characteristics of the transferred and stretched polymer films with 60% strain perpendicular to the channel direction.

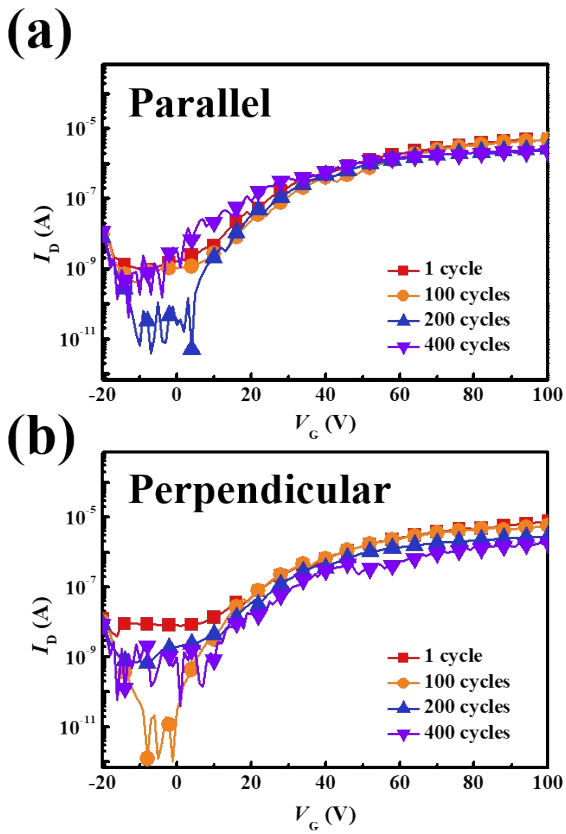

Fig. S26. FET transfer characteristics of the transferred and stretched polymer films after different stretching-releasing cycles with 60% strain (a) parallel (b) perpendicular to the channel direction.