Supporting Information

Exploring Lateral and Vertical Phase Separation in SEBS and Dibenzochrysene Derivatives Polymer Blends

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Molecular characterization

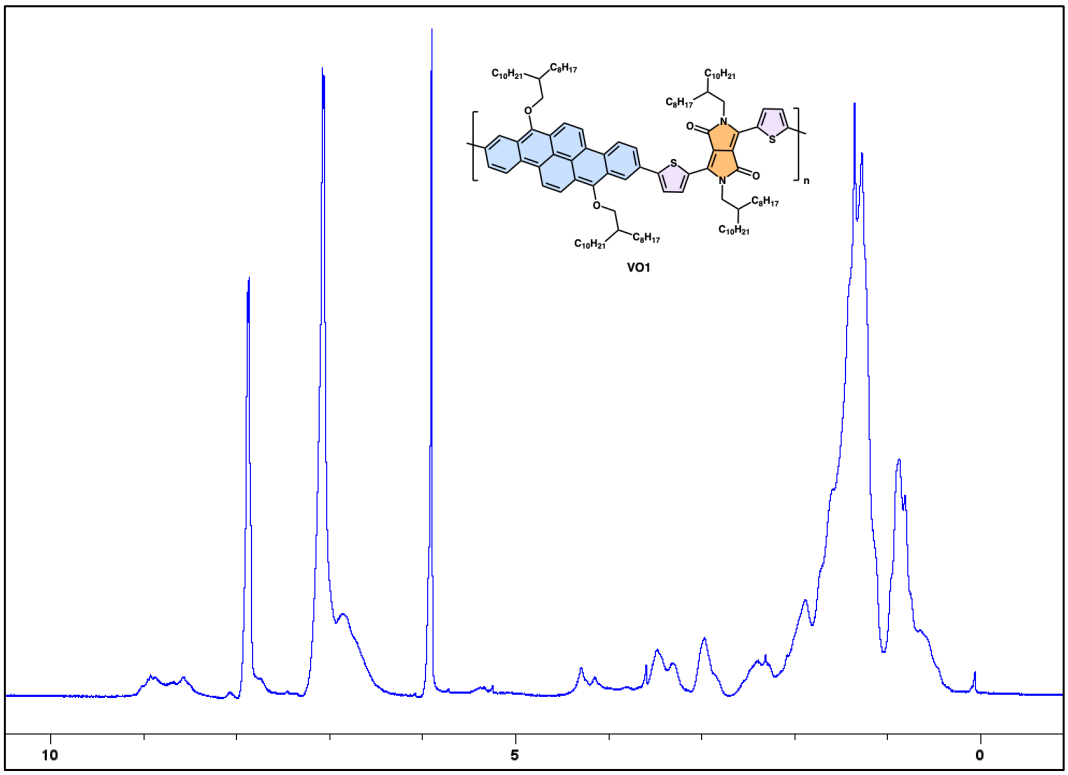

Figure S1. ^{1}H NMR spectrum of VO1 polymer in 1,1,2,2-tetrachloroethane at 140°C.

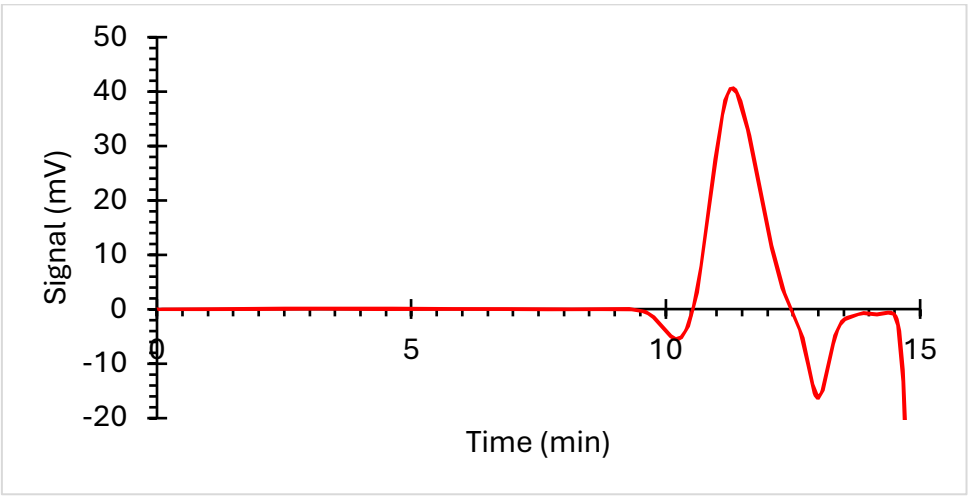

Figure S2. Size exclusion chromatography trace for VO1 polymer (M_n =17.4 kg.mol^{-1}, M_w = 26.2 kg.mol^{-1}, dispersity index ($Đ$) = 1.5, X_n = 10).

Thermal characterization

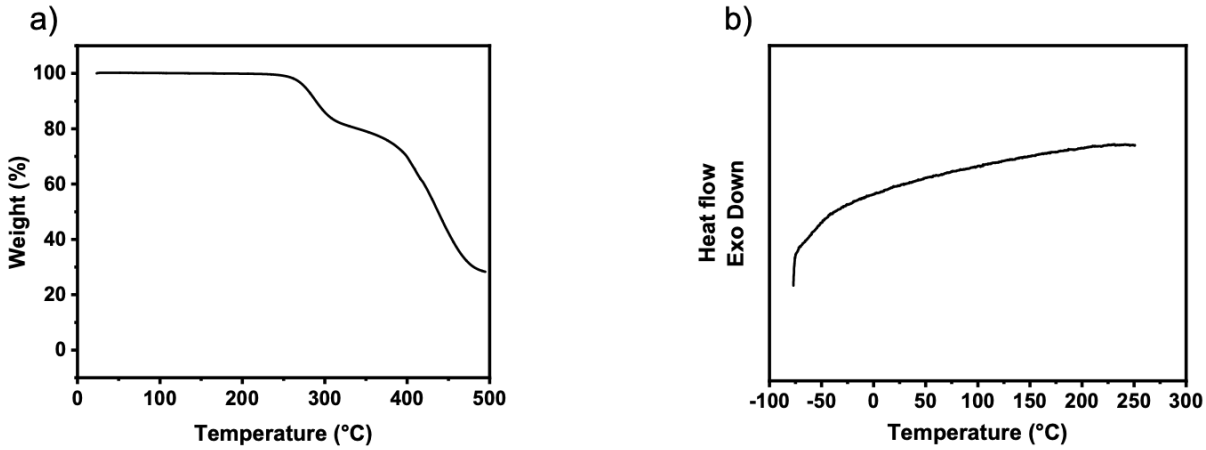

Figure S3. VO1 polymer thermal characterization a) TGA curve and b) DSC second heating curve. Both experiments are performed under nitrogen atmosphere and with a heating rate of 10 °C/min.

Optical characterization

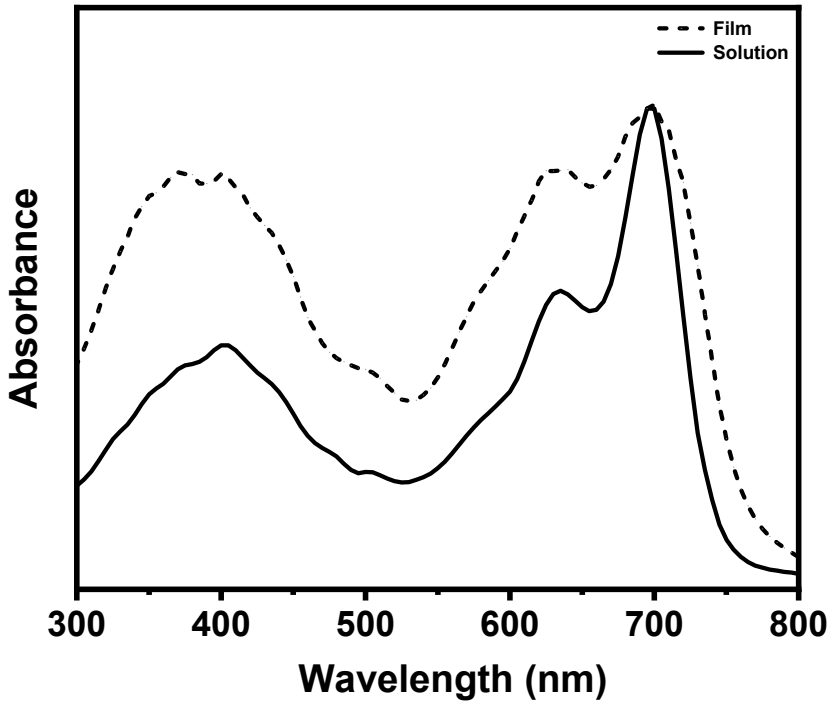

Figure S4. UV-visible spectra of a VO1 solution prepared in $CHCl_3$ (full curve) and its drop-cast film from a $CHCl_3$ solution (dashed curve). Transmission UV–vis measurements were performed using a Cary 60 spectrophotometer on both solutions and drop-cast films. In both cases, chloroform was used as the solvent and it was chosen to facilitate solvent evaporation during film formation.

Microstructure analyses

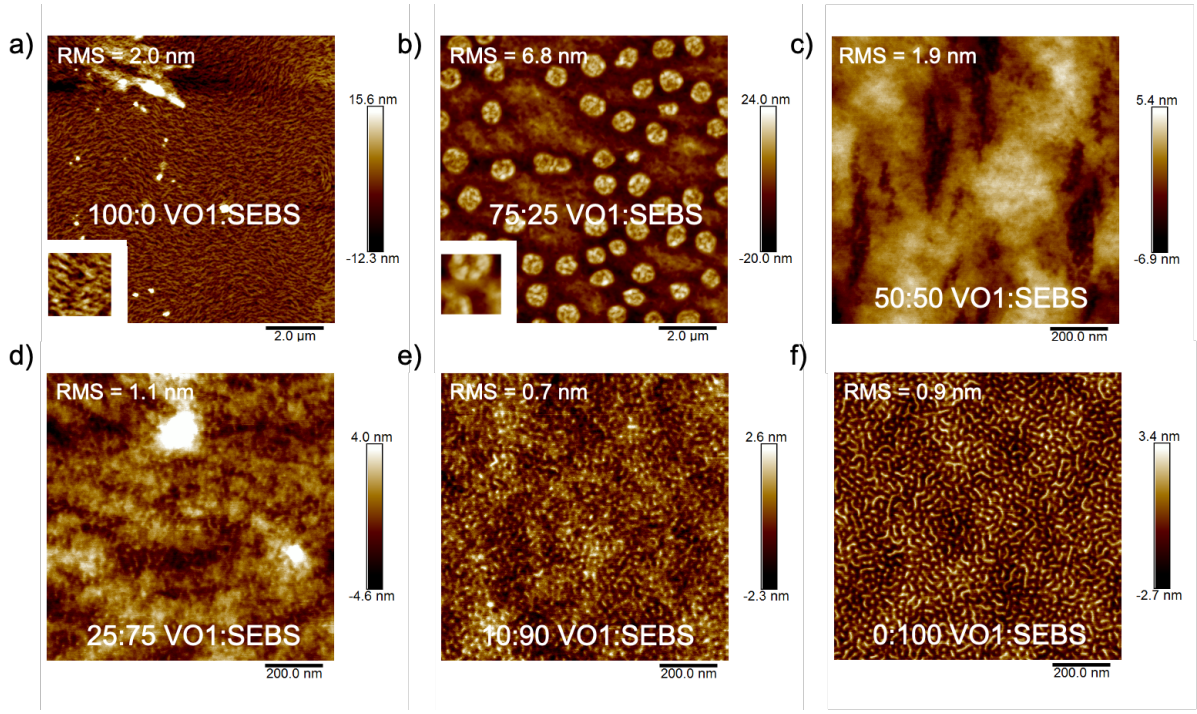

Figure S5. AFM height images of VO1:SEBS spin-coated films: a) 100:0 VO1:SEBS, b) 75:25 VO1:SEBS, c) 50:50 VO1:SEBS, d) 25:75 VO1:SEBS, e) 10:90 VO1:SEBS, f) 0:100 VO1:SEBS.

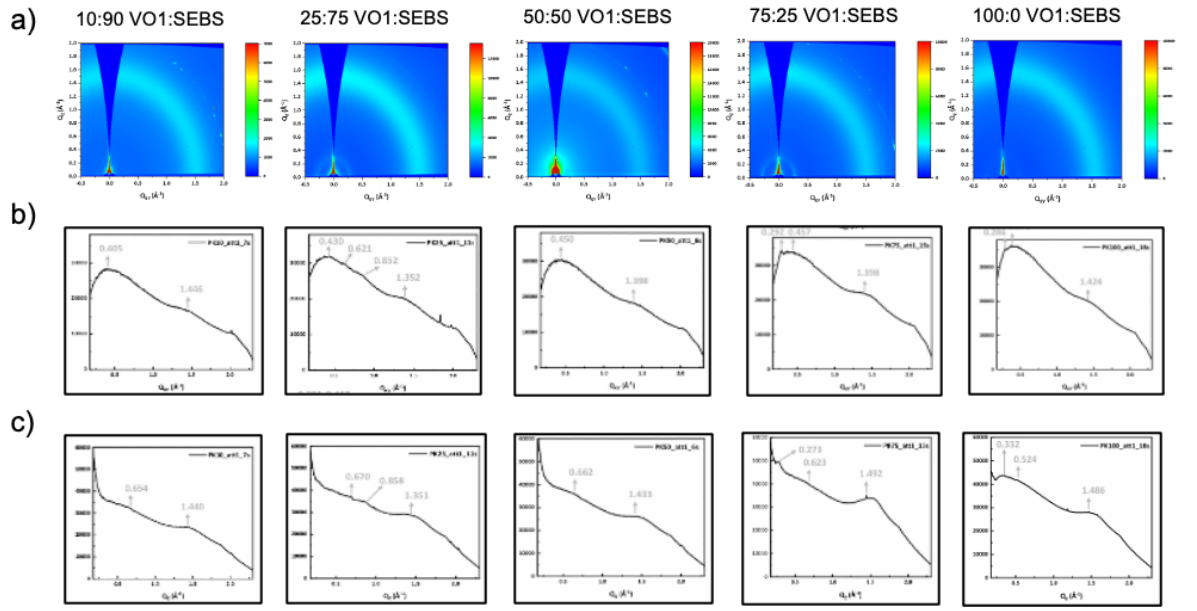

Figure S6. GIWAXS (a) 2D graphs, (b) 1D graphs qxy direction, (c) 1D graphs qz direction for VO1:SEBS polymer blends.

Table S1. *d* - spacing values in Z directions

Sample	Z Direction - q value ($Å^{-1}$)/ d-spacing $2\pi/q$ (Å)			
	q_z^1	q_z^2	q_z^3	q_z^4
10:90 VO1:SEBS	-	0.654 d = 9.602	-	1.440 d = 4.361
25:75 VO1:SEBS	-	0.670 d = 9.373	0.858 d = 7.319	1.351 d = 4.648
50:50 VO1:SEBS	-	0.662 d = 9.486	-	1.433 d = 4.382
75:25 VO1:SEBS	0.273 d = 23.004	0.623 d = 10.080	-	1.492 d = 4.209
100:0 VO1:SEBS	0.332 d = 18.916	0.524 d = 11.985	-	1.486 d = 4.226

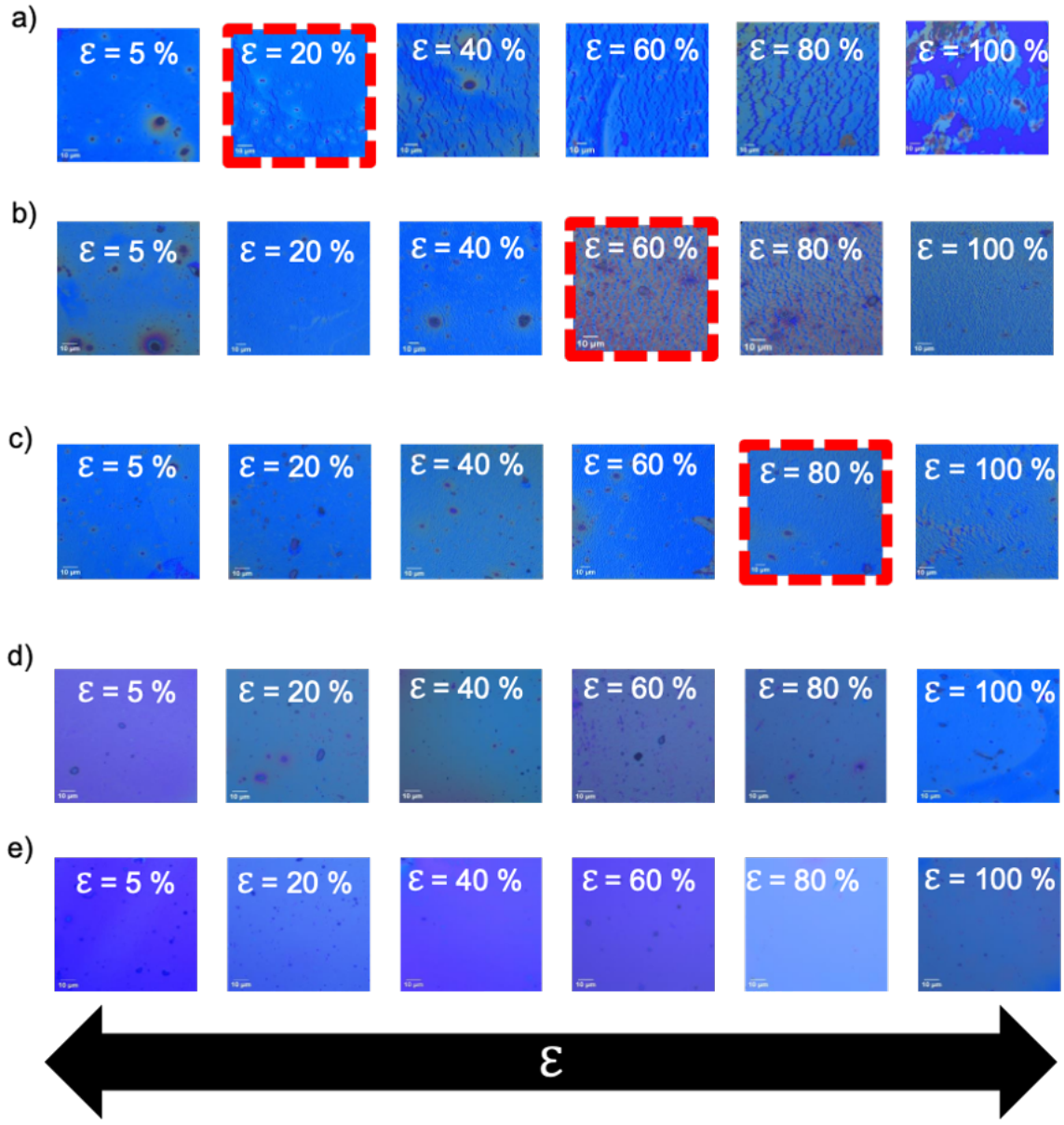

Figure S7. Optical images showing crack onset in the VO1:SEBS spin-coated films: a) 100:0 VO1:SEBS, b) 75:25 VO1:SEBS, c) 50:50 VO1:SEBS, d) 25:75 VO1:SEBS, e) 10:90 VO1:SEBS.

Table S2. Film thickness, surface roughness (RMS) and XPS final etching time of VO1:SEBS (H1052) spin-coated samples.

Sample	Thickness (nm)	RMS (nm)	XPS final etching time (s)
100:0 VO1:SEBS	35	2.0	~ 250
75:25 VO1:SEBS	37	6.8	~ 250
50:50 VO1:SEBS	40	1.9	~ 275
25:75 VO1:SEBS	41	1.1	~ 290
10:90 VO1:SEBS	43	0.7	~ 310
0:100 VO1:SEBS	35	0.9	~ 310

Quantitative Nanomechanical Mapping (QNM) Characterization

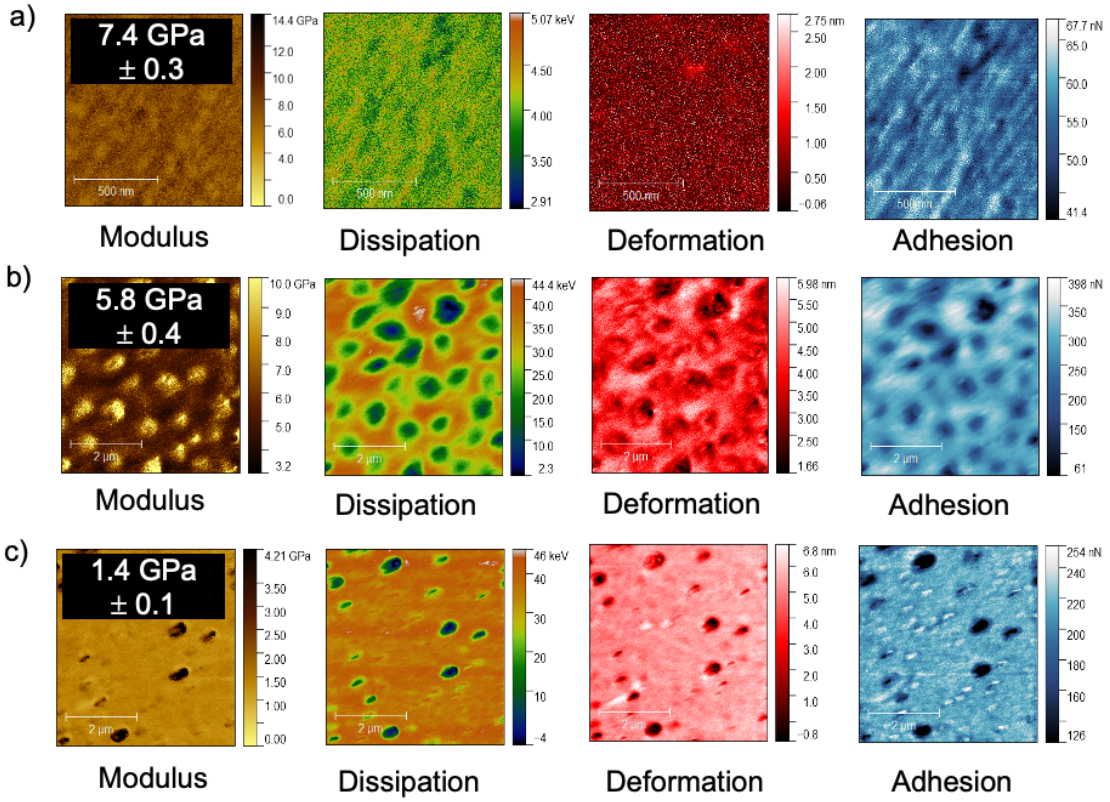

Figure S8. DMT modulus, dissipation, deformation and adhesion images via AFM for (a) 100:0 VO1:SEBS, (b) 50:50 VO1:SEBS and (c) 10:90 VO1:SEBS.

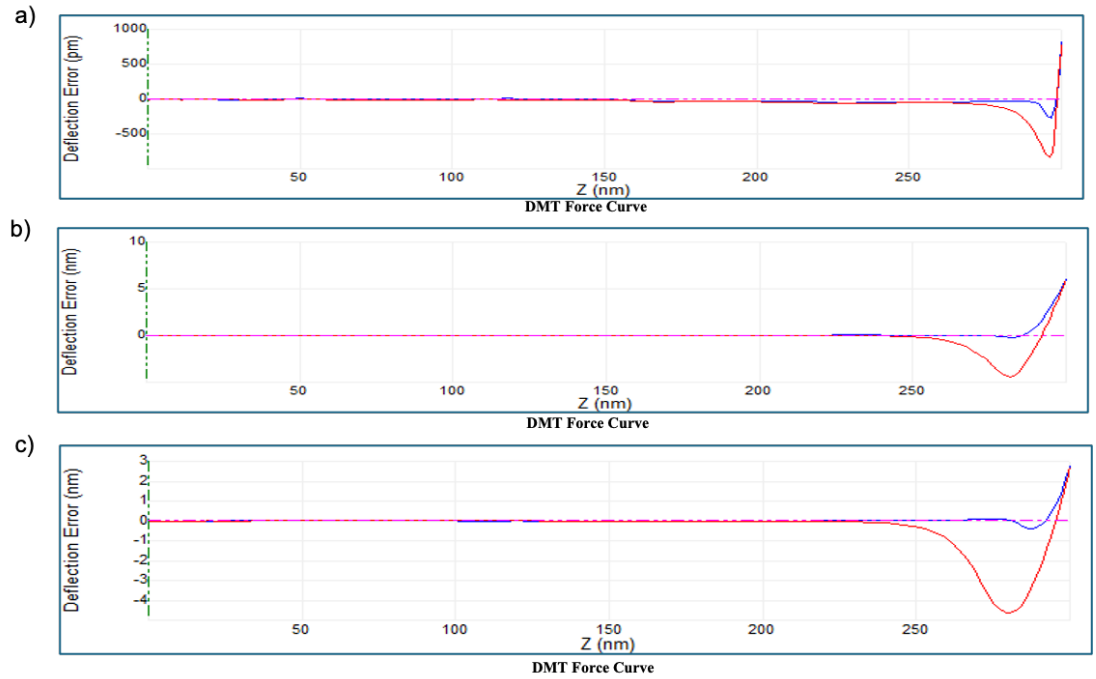

Figure S9. DMT modulus Force curves for a) 100:0 b) 50:50 and c) 10:90 VO1:SEBS blend.

Electronic characterization

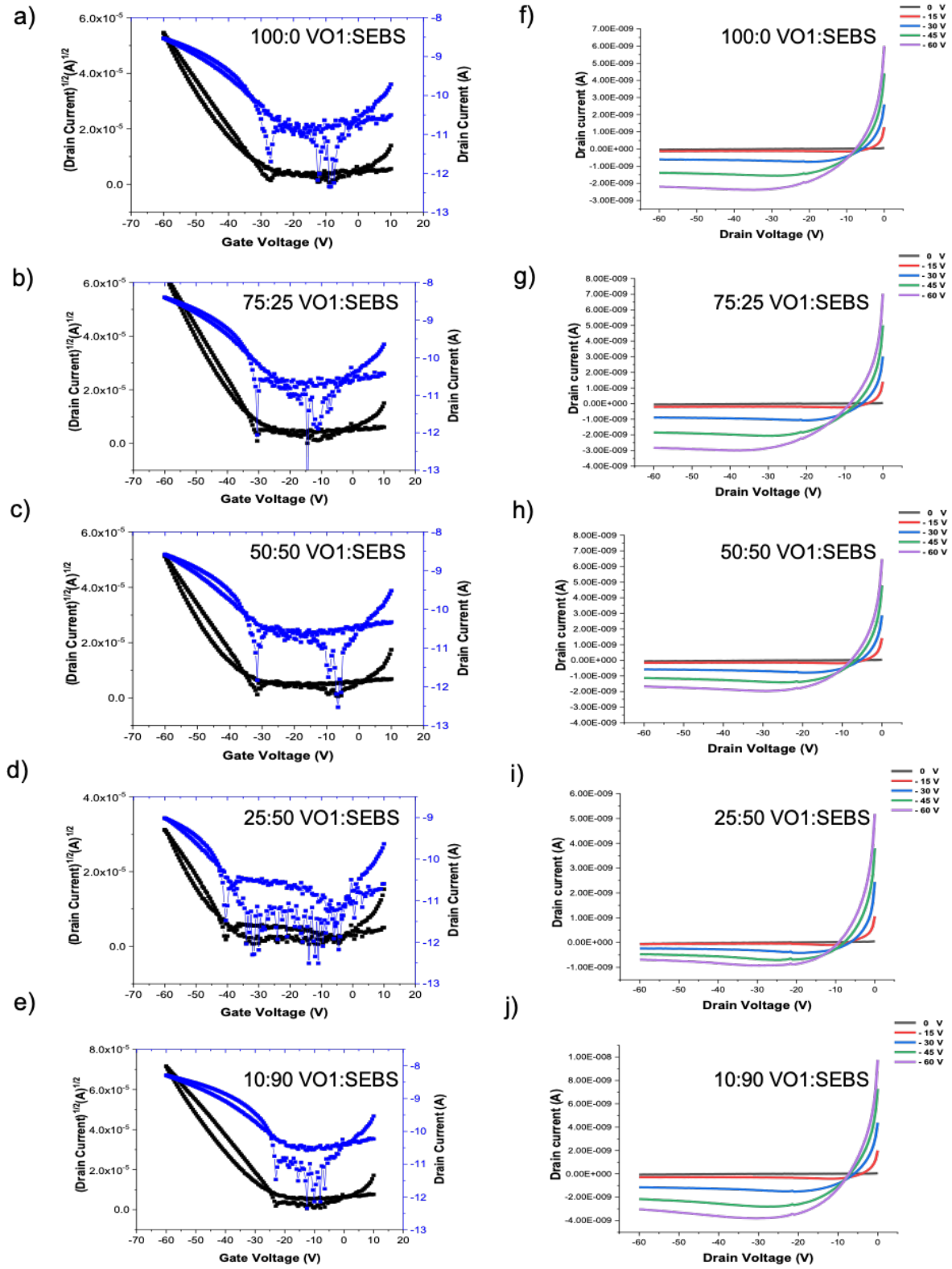

Figure S10. Transfer (a–e) and output (f–j) curves for OFET devices fabricated using 100:0 to 10:90 VO1:SEBS before thermal annealing (V_d = −60 V).

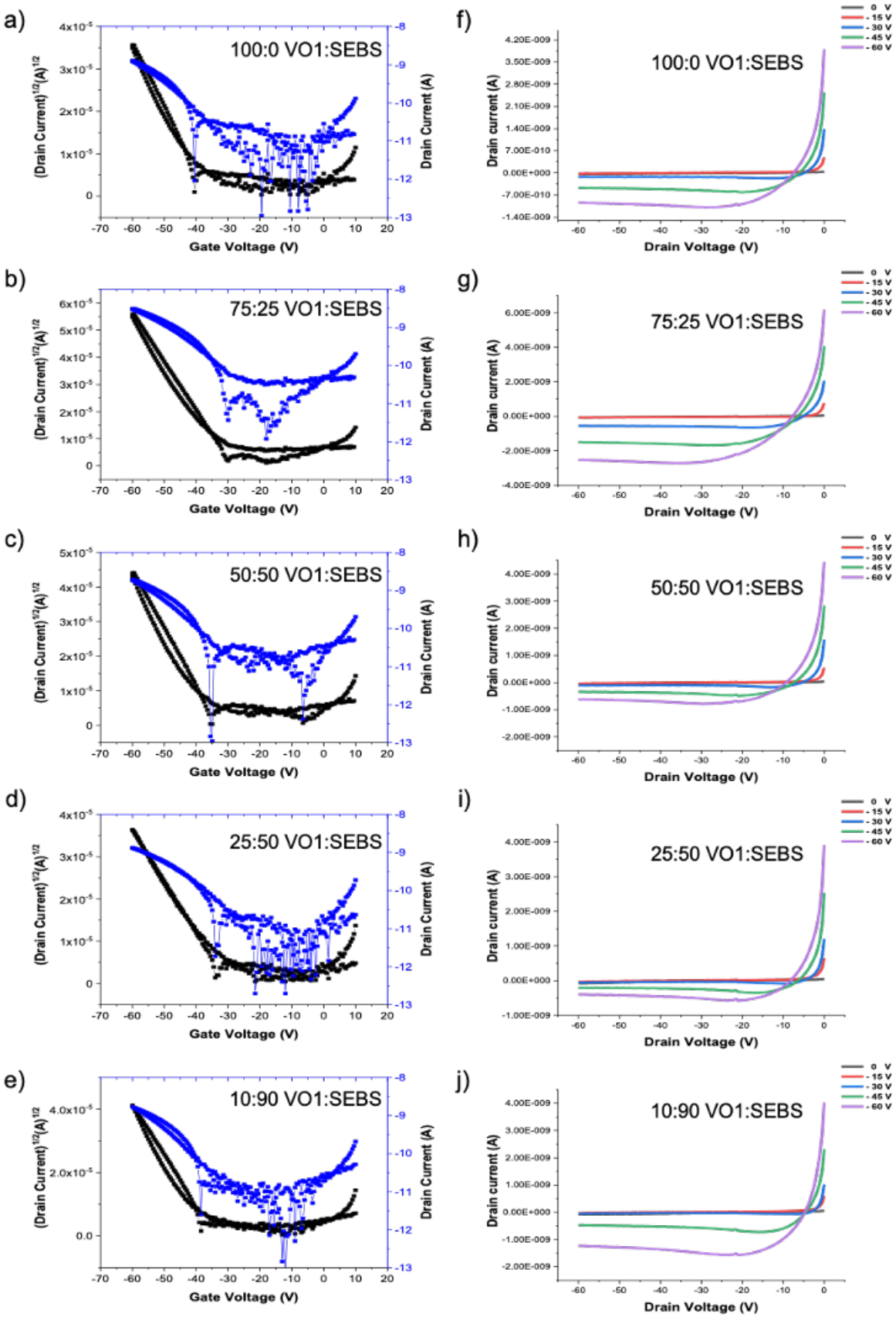

Figure S11. Transfer (a–e) and output (f–j) curves for OFET devices fabricated using 100:0 to 10:90 VO1:SEBS after thermal annealing (V_d = −60 V).

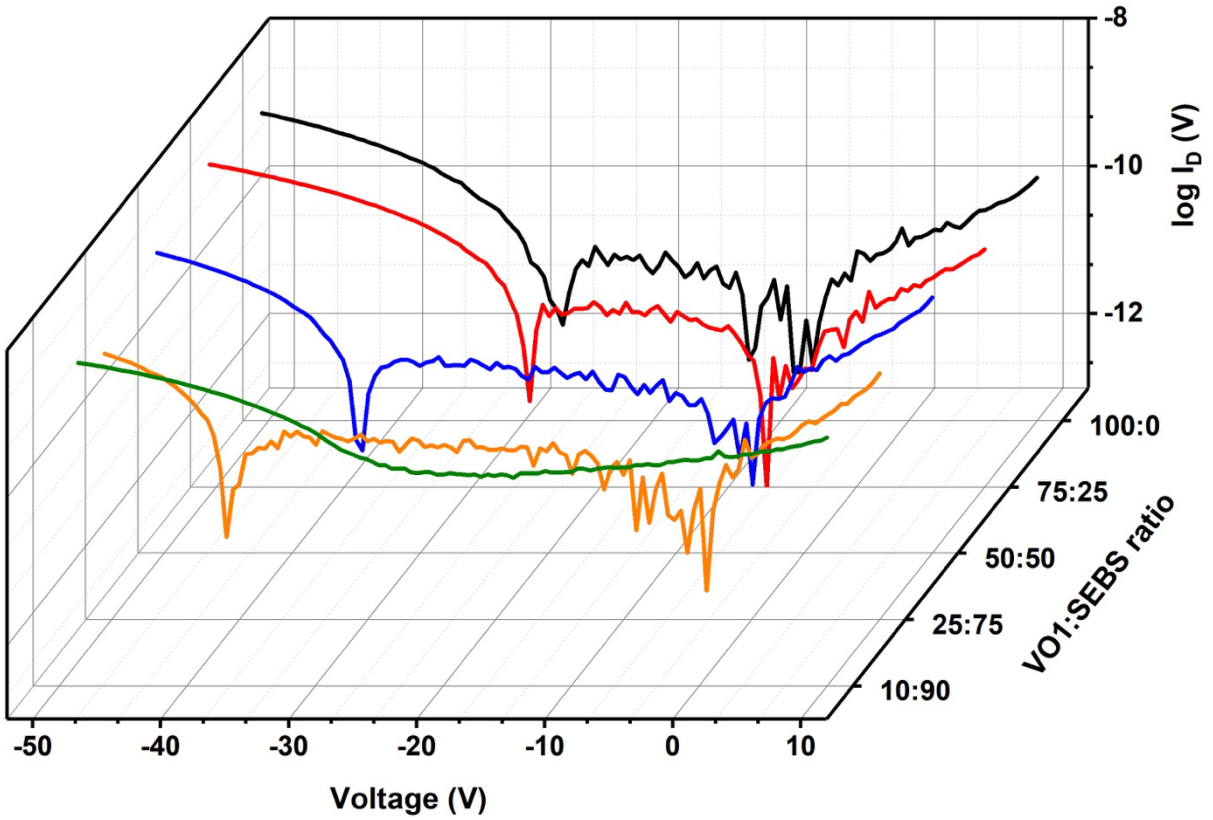

Figure S12. Transfer curves of different polymer blends (10:90 - 100:0 VO1:SEBS) before thermal annealing (V_{DS} = -60 V).

Table S3. Average (μ_h^{avg}) and maximum hole mobilities (μ_h^{max}), threshold voltages (V_{th}), and I_{on}/I_{off} ratios for OFETs fabricated using 25:75 VO1:SEBS blend, pre-stretched (0, 25 and 50% strain). The device performances were averaged from 5 devices and W/L represents width/length channel ratio.

Stretched (%)	Stretching direction	W/L	μ_h^{avg}/μ_h^{max} (cm^2 V^{-1} s^{-1}) x 10^{-5}	I_{on}/I_{off}	V_{th}^{avg} (V)
0	Parallel	10	5.3 ± 1.1 /6.4	10^2	-22.6 ± 2.7
	Perpendicular		4.6 ± 0.7 /5.5		-22.3 ± 3.3
25	Parallel	10	1.6 ± 0.7 /2.4	10^2	-28.6 ± 3.1
	Perpendicular		2.5 ± 0.6 /3.1		-22.9 ± 2.8
50	Parallel	10	1.9 ± 0.6 /2.6	10^2	-30.4 ± 1.4
	Perpendicular		2.7 ± 1.0 /3.9		-37.9 ± 4.4

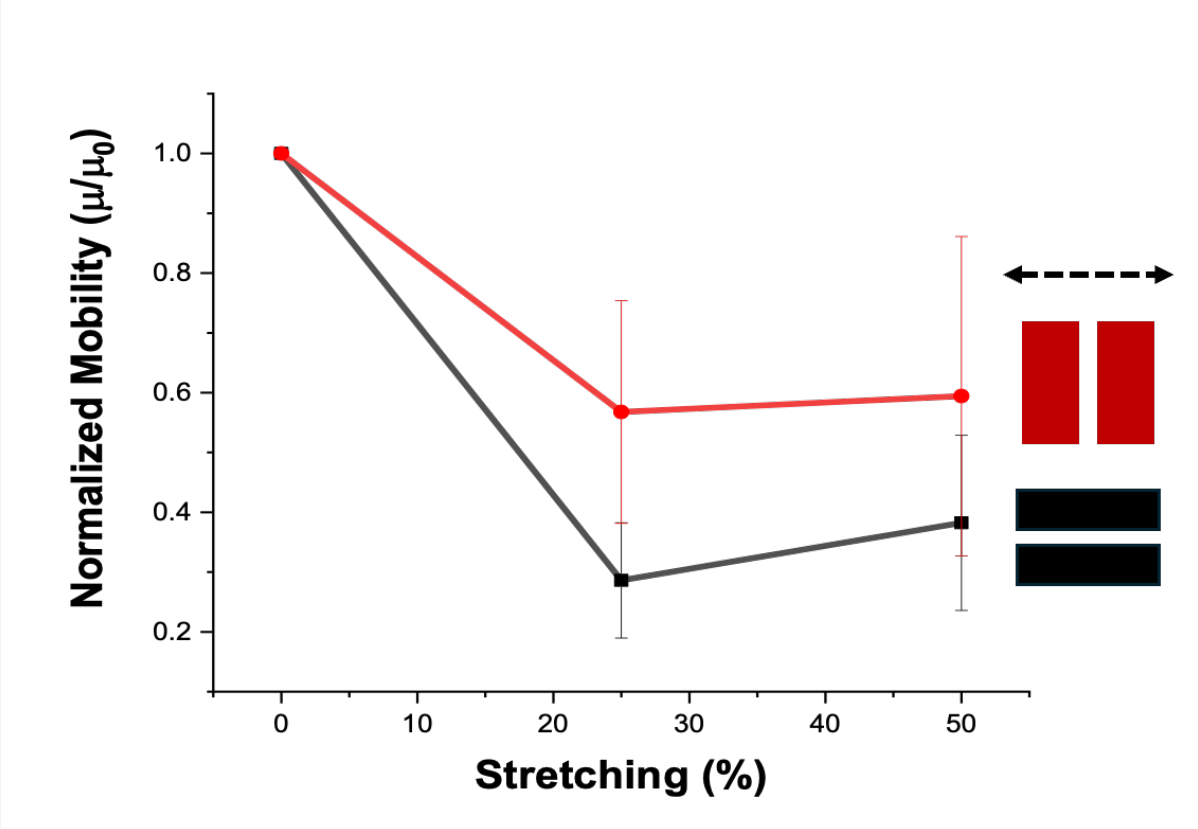

Figure S13. Charge mobility values of 25:75 VO1:SEBS blend stretched films, normalized by initial value at 0 % strain for charge transport oriented parallel and perpendicular to the strain direction.

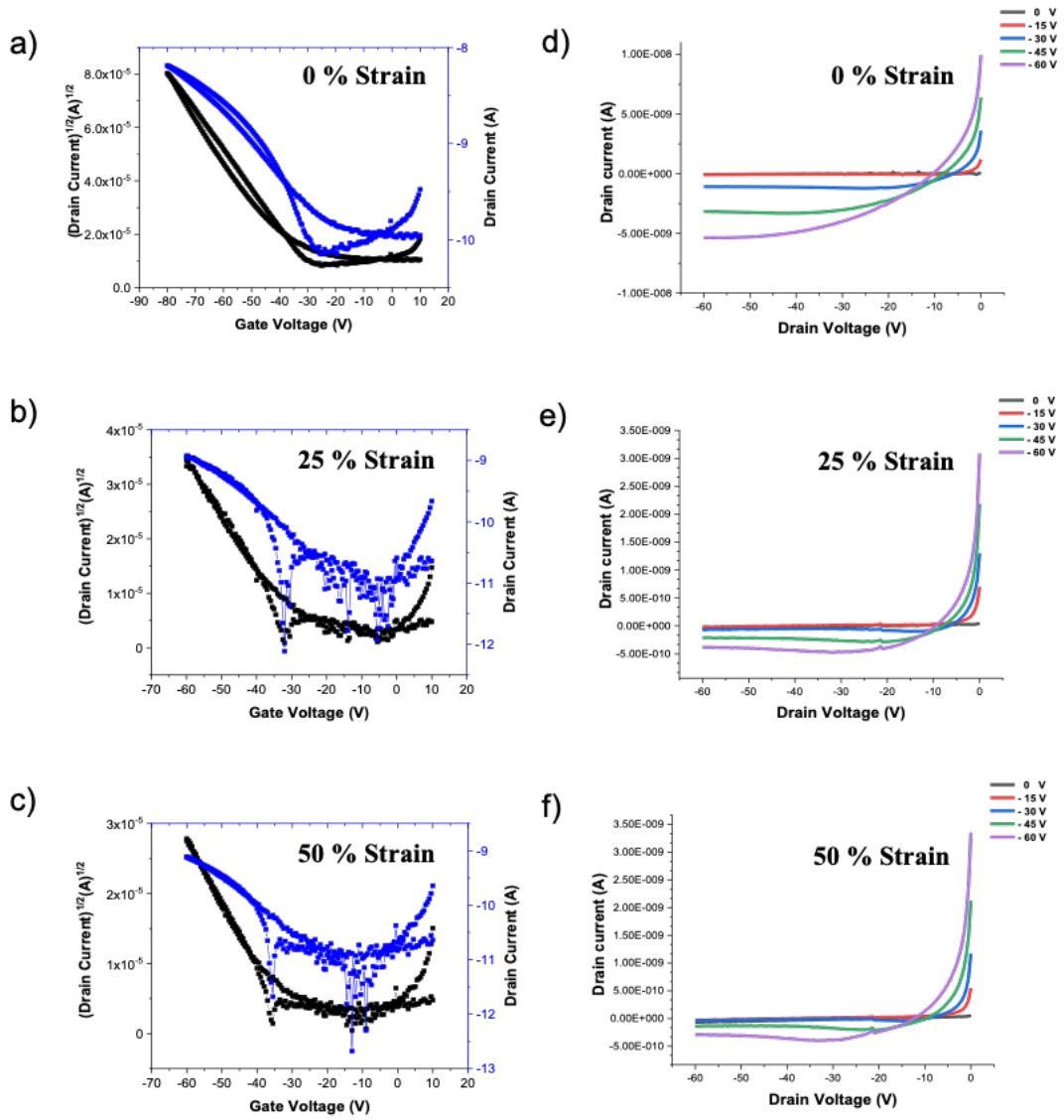

Figure S14. Transfer (a–c) and output (e–f) curves for OFET devices fabricated using transferred pre-stretched 25:75 VO1:SEBS polymer blend films on SiO_2 at different applied strains: strain is parallel to the charge transport. No annealing treatment was performed for these measurements and $V_d = -60V$.

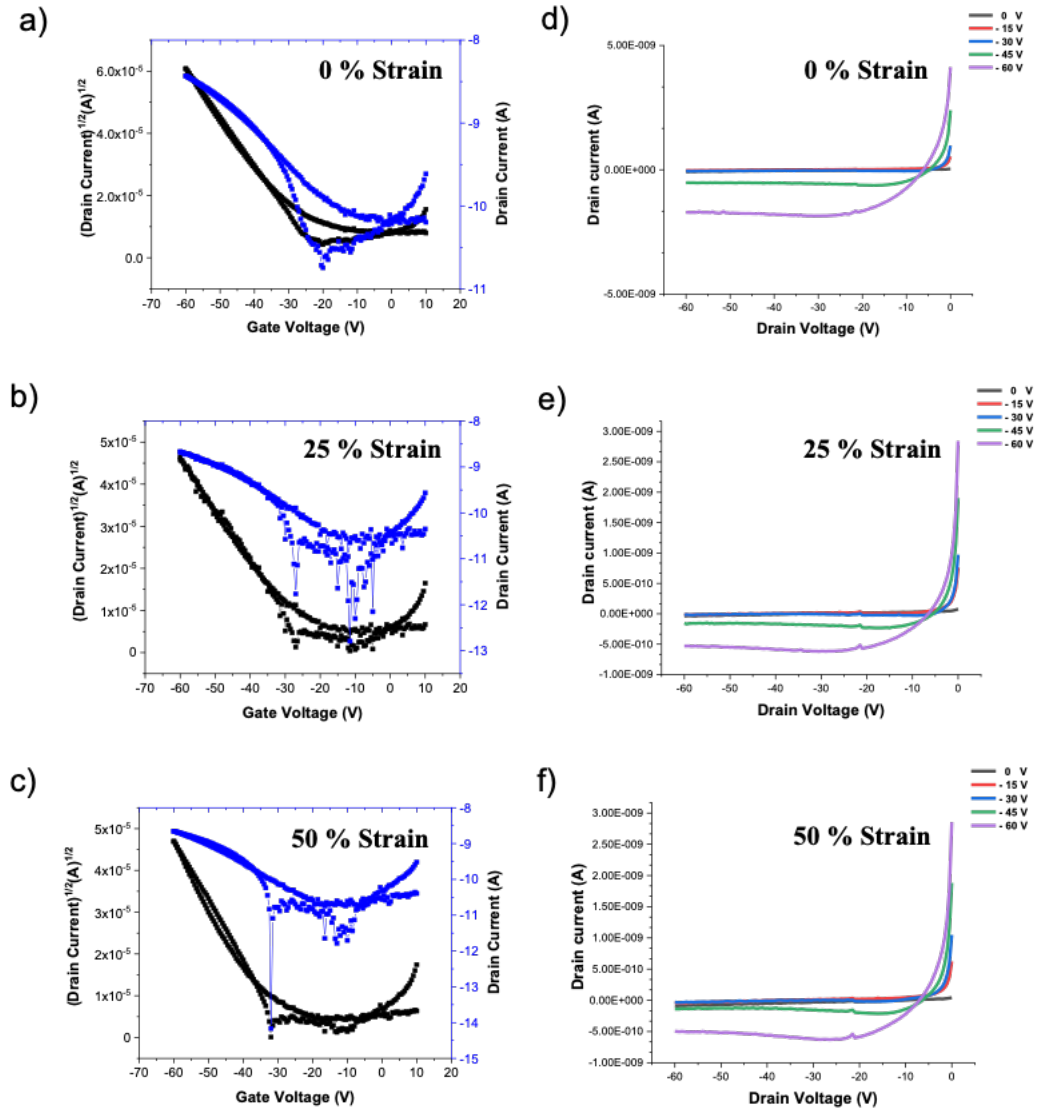

Figure S15. Transfer (a–c) and output (e–f) curves for OFET devices fabricated using transferred pre-stretched 25:75 VO1:SEBS polymer blend films on SiO_2 at different applied strains: strain is perpendicular to the charge transport. No annealing treatment was performed for these measurements and $V_d = -60V$.