SUPPORTING INFORMATION

Tensile properties of two-dimensional poly(3-hexyl thiophene) thin films as a function of thickness

Can Zhang,[a] Hongbing Yao,[a] Gang Huang,[a] Xiaohong Wang*[a,b] and Longzhen Qiu*[a,b,c]

[a] National Engineering Lab of Special Display Technology, State Key Lab of Advanced Display Technology, Academy of Opto-Electronic Technology, Hefei University of Technology, Hefei, 230009, China

[b] Anhui Key Laboratory of Advanced Functional Materials and Devices, Anhui Province, School of Chemistry and Chemical Engineering, Hefei University of Technology, Hefei, 230009, China

[c] Anhui Province Key Laboratory of Measuring Theory and Precision Instrument, Hefei University of Technology, Hefei, 230009, China

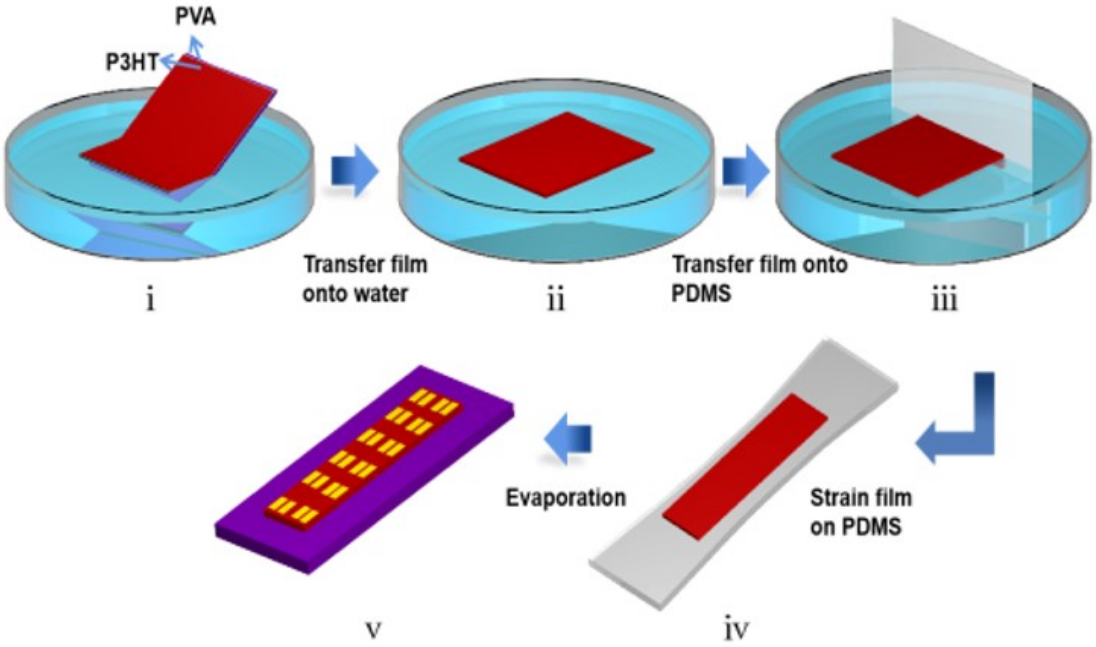

FIG S1. Schematic diagram of control P3HT thick film stretching process.

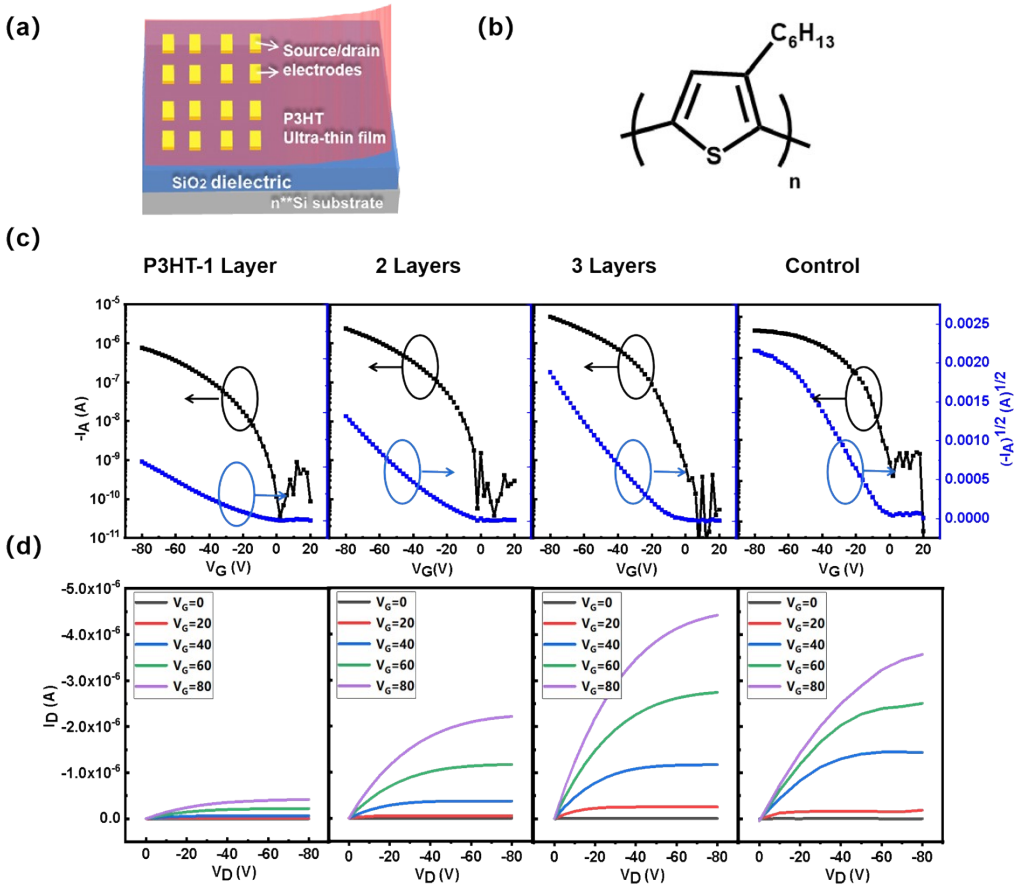

Figure S2. Schematic diagram of (a) ultra-thin P3HT 3-layer device. (b) P3HT molecular structure. (c-d) OFET transfer and output curves of 1–3 layers laminated P3HT films and control P3HT film.

Table S1. Electrical performance parameters of P3HT films with different stretching degrees.

Polymer	Strain Direction	Strain (%)	Mobility ($cm^2 V^{-1} s^{-1}$) max	Mobility ($cm^2 V^{-1} s^{-1}$) average	V_{th} (V)	I_{on}/I_{off}
P3HT-1Layer	Parallel	0	2.81×10^{-3}	2.47×10^{-3}	-17.7	$\sim10^4$
		10	2.63×10^{-3}	2.24×10^{-3}	-19.1	$\sim10^4$
		30	1.45×10^{-3}	1.35×10^{-3}	-18.3	$\sim10^4$
		50	1.22×10^{-3}	1.08×10^{-3}	-22.8	$\sim10^4$
		100	6.84×10^{-4}	6.06×10^{-4}	-20.1	$\sim10^3$
	Perpendicular	0	2.81×10^{-3}	2.47×10^{-3}	-17.7	$\sim10^4$
		10	2.67×10^{-3}	2.30×10^{-3}	24.8	$\sim10^4$
		30	2.32×10^{-3}	1.93×10^{-3}	-15.5	$\sim10^4$
		50	1.49×10^{-3}	1.45×10^{-3}	-20.7	$\sim10^4$
		100	5.04×10^{-4}	4.38×10^{-4}	-18.4	$\sim10^4$
P3HT-2Layers	Parallel	0	1.76×10^{-2}	1.70×10^{-2}	-11.5	$\sim10^5$
		10	1.56×10^{-2}	1.35×10^{-2}	-19.0	$\sim10^4$
		30	5.27×10^{-3}	4.66×10^{-3}	-20.6	$\sim10^4$
		50	3.42×10^{-3}	3.20×10^{-3}	-22.4	$\sim10^4$
		100	7.54×10^{-4}	6.96×10^{-4}	-27.7	$\sim10^3$
	Perpendicular	0	1.76×10^{-2}	1.70×10^{-2}	-11.5	$\sim10^5$
		10	1.62×10^{-2}	1.55×10^{-2}	-8.41	$\sim10^4$
		30	6.86×10^{-3}	6.12×10^{-3}	-18.7	$\sim10^4$
		50	4.69×10^{-3}	4.46×10^{-3}	-20.5	$\sim10^4$
		100	1.42×10^{-3}	1.34×10^{-3}	-15.1	$\sim10^4$
P3HT-3Layers	Parallel	0	3.34×10^{-2}	2.71×10^{-2}	-10.2	$\sim10^5$
		10	9.90×10^{-3}	9.42×10^{-3}	-13.3	$\sim10^4$
		30	5.18×10^{-3}	4.92×10^{-3}	-16.4	$\sim10^4$
		50	2.33×10^{-3}	2.17×10^{-3}	-18.0	$\sim10^4$
		100	7.09×10^{-4}	5.83×10^{-4}	-14.5	$\sim10^3$
	Perpendicular	0	3.34×10^{-2}	2.71×10^{-2}	-10.2	$\sim10^5$
		10	1.61×10^{-2}	1.31×10^{-2}	-15.8	$\sim10^4$
		30	1.02×10^{-2}	8.85×10^{-3}	-13.3	$\sim10^4$
		50	4.42×10^{-3}	3.97×10^{-3}	-18.9	$\sim10^3$
		100	6.26×10^{-4}	6.18×10^{-4}	-14.5	$\sim10^2$
Control	Parallel	0	1.87×10^{-2}	1.75×10^{-3}	-5.5	$\sim10^4$
		10	2.65×10^{-3}	2.44×10^{-3}	-20.7	$\sim10^4$
		30	5.56×10^{-4}	4.63×10^{-4}	-24.3	$\sim10^3$
		50	4.91×10^{-5}	4.37×10^{-5}	-13.3	$\sim10^2$
		100	1.98×10^{-5}	1.25×10^{-5}	-22.5	$\sim10^2$
	Perpendicular	0	1.87×10^{-2}	1.75×10^{-3}	-5.5	$\sim10^4$
		10	5.13×10^{-3}	4.80×10^{-3}	-7.37	$\sim10^3$
		30	1.22×10^{-3}	1.07×10^{-3}	-7.59	$\sim10^3$
		50	1.21×10^{-3}	8.11×10^{-4}	-8.92	$\sim10^3$
		100	2.99×10^{-4}	1.96×10^{-3}	-2.54	$\sim10^3$

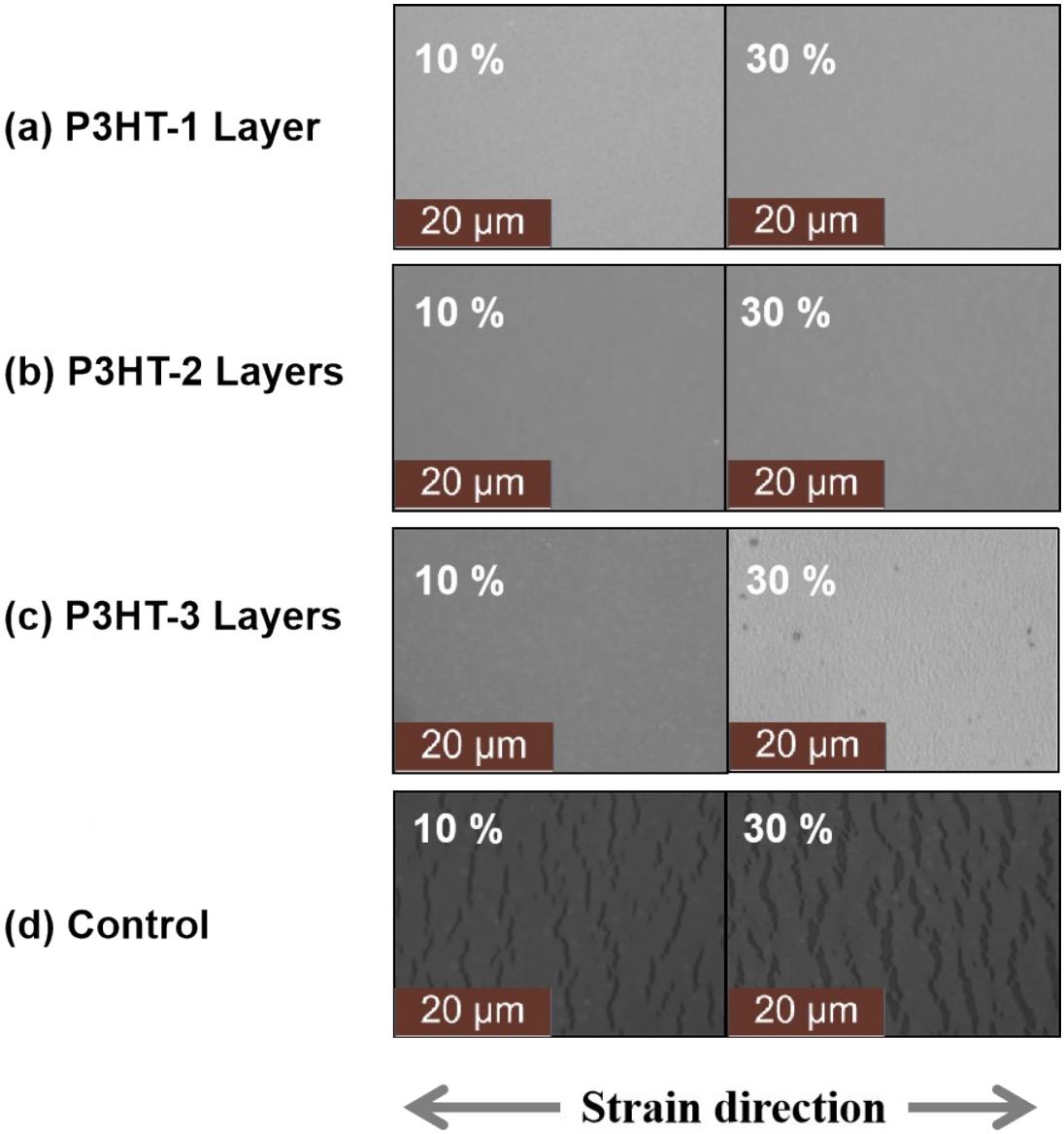

Figure S3. Metallographic microscope images of different layers of P3HT ultra-thin films and control group under different tensile strains. The number of P3HT layers from top to bottom are: (a) P3HT-1 Layer, (b) P3HT-2 Layers, c) P3HT-3 Layers, and (d) control group. From left to right, stretch from 10% to 30%.

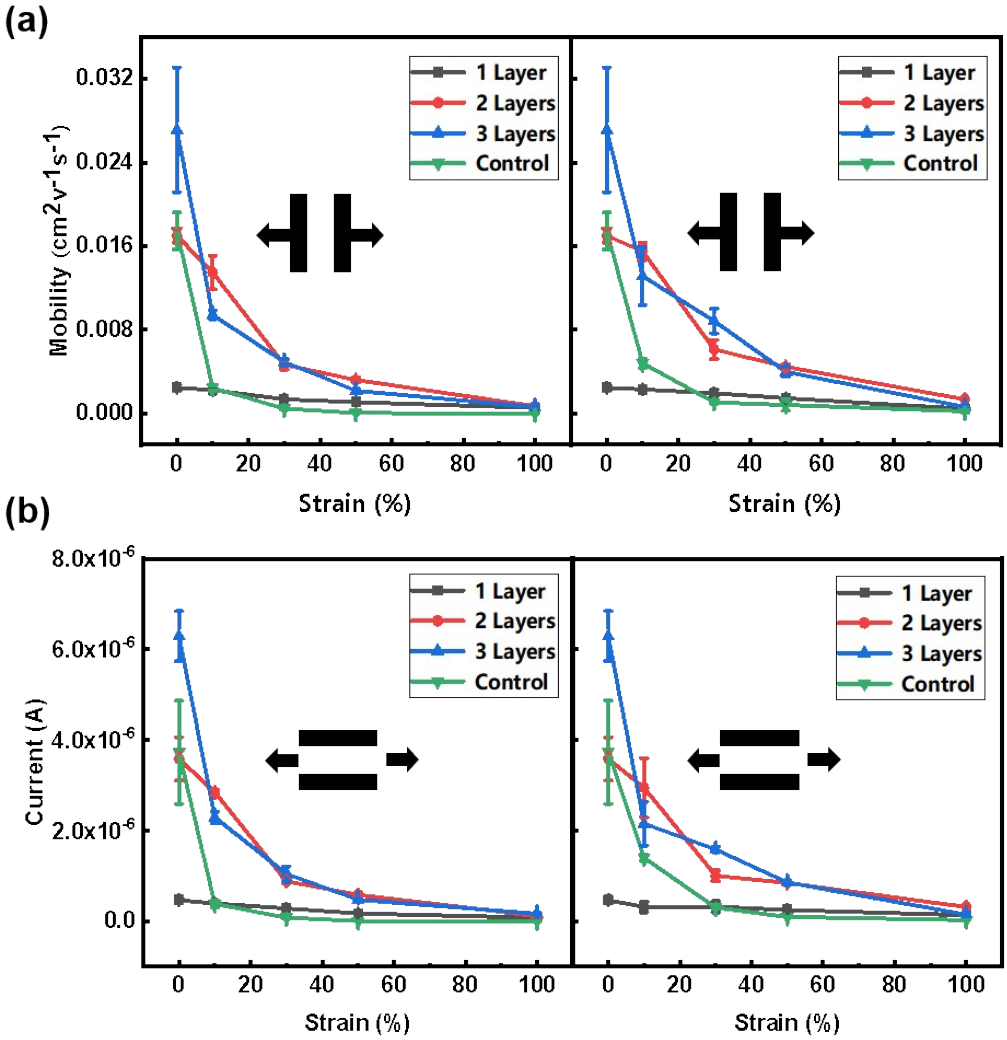

Figure S4. (a) Average FET mobility of the studied polymer thin films under stretching strains from 0% to 100%. (b) The average maximum on-state current of the studied polymer thin films under stretching strains from 0% to 100%.

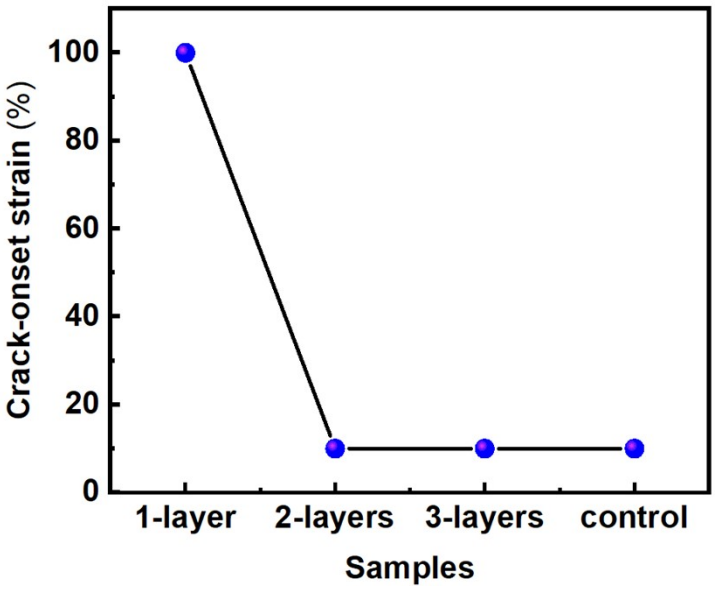

Figure S5. Crack-onset strain of P3HT 1-layer, P3HT 2-layers, P3HT 3-layers, thicker control films.

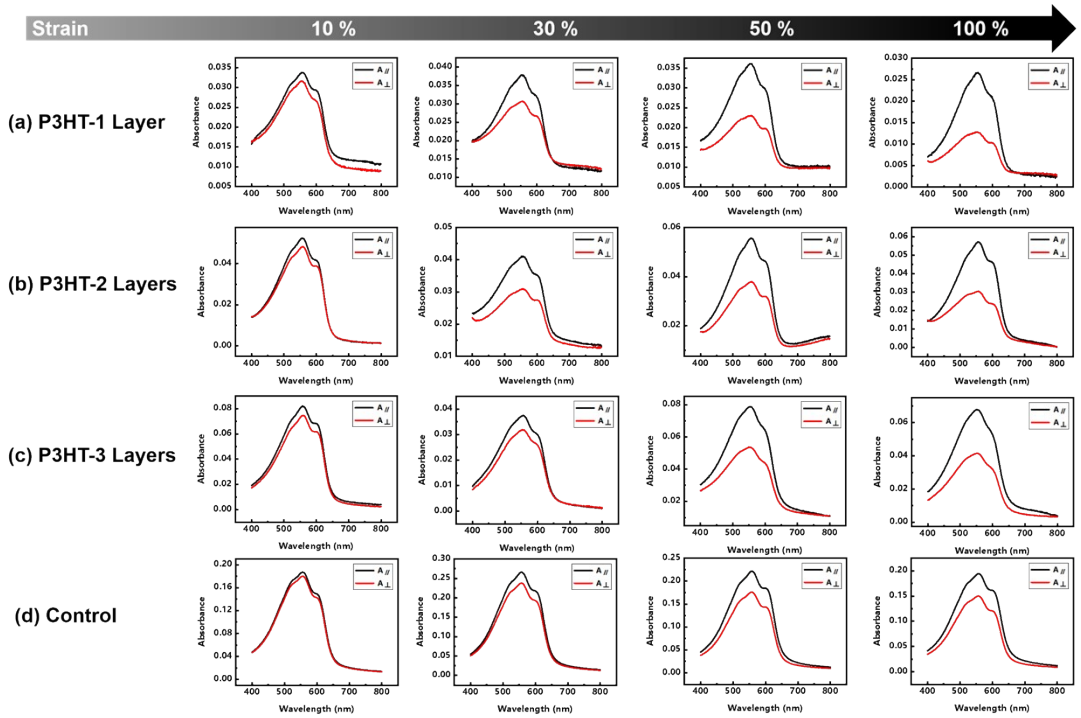

Figure S6. Polarized ultraviolet-visible absorption spectra of different P3HT layers and control groups under different stretching degrees. The number of P3HT layers from top to bottom are: (a) P3HT-1 Layer, (b) P3HT-2 Layers, c) P3HT-3 Layers, and (d) control group. From left to right, stretching from 0% to 100% (the black line represents parallel to the stretching direction, and the red line represents perpendicular to the stretching direction).