Supporting Information

Flexible Small-Channel Thin-Film Transistors by Electrohydrodynamic Lithography

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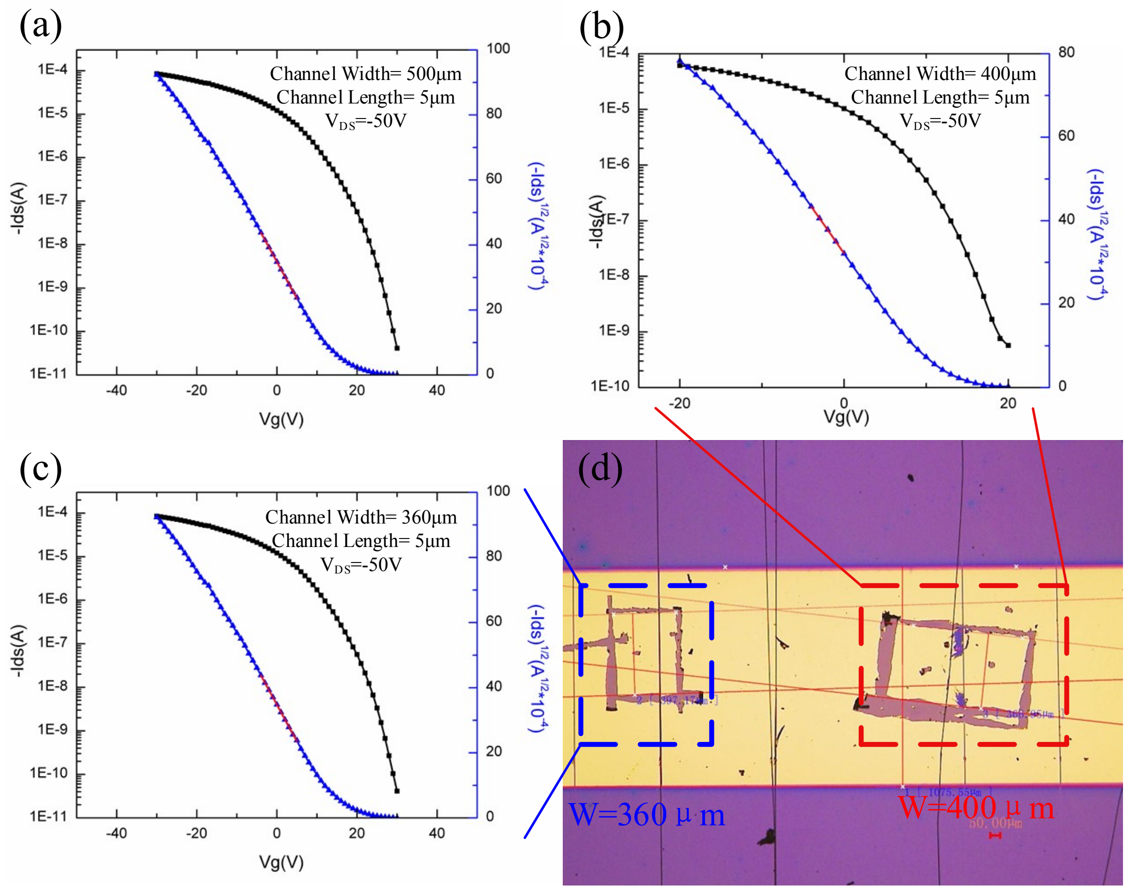

Fig. S1. TFT performance characteristics. (a) Transfer characteristics of devices with the continuous channel layer at source/drain voltage (V_{DS}) of -50 V. (b) and (c) Transfer characteristics of devices with the isolated channel layer at source/drain voltage (V_{DS}) of -50 V. (d) The laser scanning confocal microscope (LSCM) image of the TFTs with the isolated channel layer.

Text S1

The contact resistance is the resistance between the source/drain electrodes and the semiconductor layer, and the value is not related to the channel length. In order to achieve the smaller contact resistance, we choose the gold for the source/drain electrodes and ensure that the interfaces between the electrodes and the semiconductor layer are as flat as possible.

The electrochemical properties of the thin film of PDPP5T were characterized with cyclic voltammetry (CV).[1] The HOMO level and the LUMO level of PDPP5T are calculated from the onset oxidation potential (~0.32 V) and the onset reduction potential (~−1.28 V) to be −5.12 eV and −3.55 eV, respectively. The HOMO energy of PDPP5T very closely approaches the gold electrodes (−5.0 eV), which can greatly reduce the barrier between the two layers.

Meanwhile, the semiconductor layer is obtained on the substrate with OTS-18 SAM modification and the source/drain electrodes are deposited via thermal vacuum evaporation with the pressure under 5.0×10^{-5} Pa, which maintain the two layers having a low roughness. The AFM images of the dielectric layer and the semiconducting layer are obtained as Fig 1 shows. It is observed that the surface of the insulating layer is very flat and has a roughness of 0.34 nm. At the same time, the semiconducting layer has a higher roughness of 5.16 nm, for the layer is fabricated by spin-coating. In general, the morphologies of the layers are good enough to prepare high-performance electronic devices

The measures mentioned above can make the interface between the two layers have a good contact, which greatly reduces the contact resistance.

References:

[1] Yi Z, Sun X, Zhao Y, et al. Diketopyrrolopyrrole-based π-conjugated copolymer containing β-unsubstituted quintetthiophene unit: a promising material exhibiting high hole-mobility for organic thin-film transistors[J]. Chemistry of Materials, 2012, 24(22): 4350-4356.

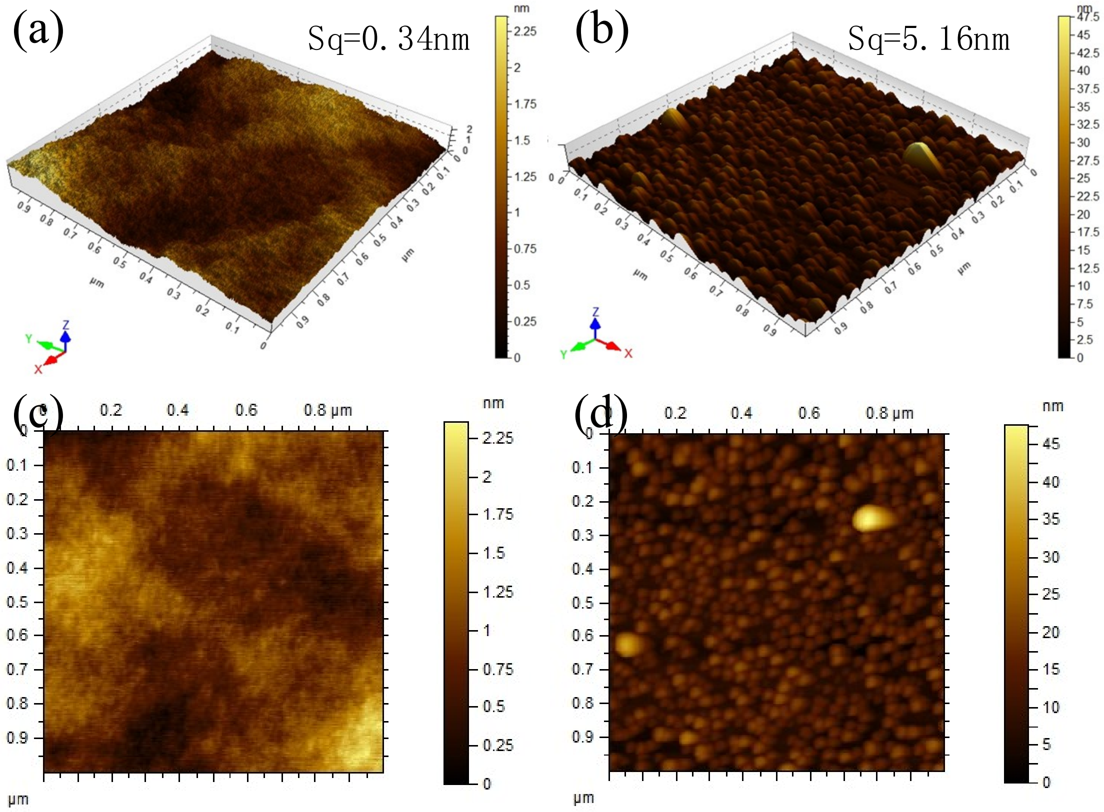

Fig S2. The 3D and 2D AFM images of the dielectric layer (a, c) and the semiconducting layer (b, d).

Table S1. The mobility and ON/OFF ratio of 75 OTFT devices.

Sample No.	Mobility ($cm^2V^{-1}s^{-1}$)	ON/OFF ratio	Sample No.	Mobility ($cm^2V^{-1}s^{-1}$)	ON/OFF ratio	Sample No.	Mobility ($cm^2V^{-1}s^{-1}$)	ON/OFF ratio
1	0.18	7.33e4	2	0.26	1.97e5	3	0.39	2.13e5
4	0.48	2.01e6	5	0.19	6.56e4	6	0.42	1.97e5
7	0.26	2.47e5	8	0.45	4.73e5	9	0.51	6.92e5
10	0.36	3.45e5	11	0.17	4.22e4	12	0.22	1.24e5
13	0.22	6.41e4	14	0.56	1.97e6	15	0.20	1.46e5
16	0.23	5.94e4	17	0.28	9.82e4	18	0.39	2.85e5
19	0.34	7.28e5	20	0.62	2.47e6	21	0.35	5.27e5
22	0.37	2.96e5	23	0.24	9.57e4	24	0.19	5.87e4
25	0.49	7.24e5	26	0.32	3.87e5	27	0.37	2.86e5
28	0.29	6.59e4	29	0.36	2.67e5	30	0.28	2.45e5
31	0.18	5.82e4	32	0.11	3.47e4	33	0.41	8.89e5
34	0.42	6.59e5	35	0.20	1.46e5	36	0.46	5.71e5
37	0.52	1.97e6	38	0.30	5.63e5	39	0.39	4.03e5
40	0.41	6.48e5	41	0.51	8.47e5	42	0.39	4.15e5
43	0.27	7.86e5	44	0.16	7.14e4	45	0.41	3.68e5
46	0.47	8.33e5	47	0.27	3.11e5	48	0.49	9.21e5
49	0.44	8.25e5	50	0.52	1.82e6	52	0.40	3.57e5
52	0.58	1.53e6	53	0.29	2.19e5	54	0.26	7.27e4
55	0.34	3.55e5	56	0.45	2.69e5	57	0.34	2.80e5
58	0.35	5.33e5	59	0.54	6.56e5	60	0.23	6.46e4
61	0.18	6.94e4	62	0.44	5.49e5	63	0.44	4.37e5
64	0.26	3.51e5	65	0.28	2.32e5	66	0.55	7.81e5
67	0.50	6.94e5	68	0.29	1.34e5	69	0.27	7.26e4
70	0.22	7.52e5	71	0.22	8.75e4	72	0.39	6.92e5
73	0.20	3.26e5	74	0.42	5.43e5	75	0.31	2.97e5

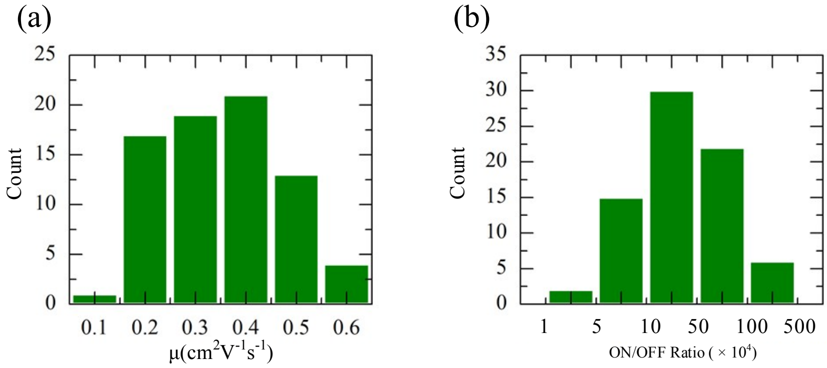

Fig. S3. The normal distribution of TFT performance characteristics of OTFT devices: the mobility (a) and the ON/OFF ratio (b).