Supplementary Information for:

An Inkjet–Printed TTF-TCNQ Nanoweb as an Effective Modification Layer for High Mobility Organic Field–Effect Transistors

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Equipment:

AFM (Dimension Fast Scan), powder XRD (Siemens D5005), Jet-Printer (Jetlab II Microfab technologies), high–vacuum evaporation system (Keyi), sublimation system (Thermal three-zone tube furnace equipped with molecular pump, gas flowmeter and 99.999 % Ar).

Purification:

The sublimation was performed in a horizontal quartz tube mounted inside a 3 temperature zones furnace which was equipped with molecular pump, gas flowmeter and 99.999 % Ar. Pentacene was placed in the first zone in a inner tube, and evacuated to 10^{-4} Pa, then change the pressure to 10^{-2} Pa by adjusting Ar flow. At this stable vacuum, the three zones was gentaly heated to 275, 220, 180 ^{o}C. After 12 hours sublimation, the furnace was turned off and cooled to RT. Then the pentacene in second zone was carefully collected. The purification of TTF and TCNQ were similar with pentacene at different zones temperatures (TTF 200, 150, 100 ^{o}C, and TCNQ 230, 175, 120 ^{o}C respectively).

Ink production

Highly purified TTF and TCNQ are combined in acetonitrile solvent the 1:1 complex prexipitates from the solution. Then recrystallization of the complex from dry deoxygenated acetonitrile provided thin shiny crystal plates. 1 mg complex was soluted into 100 ml 1,4–dioxane with sonication assistance, and then dilute to different concentration.

Ink concentration (mgml^{-1})	Ink volume (μLcm^{-2})	Mobility (cm^{2}V^{-1}s^{-1})	on/off ratio
10^{-3}	1	2.2~2.7	1×10^{2}
10^{-4}	1	3.6~4.2	2×10^{3}
10^{-5}	1	3.4~3.8	8×10^{5}
10^{-6}	1	0.5~1.1	5×10^{6}
10^{-7}	1	0.08~0.2	4×10^{4}
10^{-5}	10	3.1~3.7	3×10^{3}
10^{-5}	5	3.5~4.0	7×10^{3}
10^{-5}	0.1	0.4~1.0	2×10^{6}
10^{-5}	0.01	0.1~0.2	8×10^{4}

Table S1 Field-effect mobilities, on/off ratios, of pentacene transistors fabricated at TTF-TCNQ nanoweb printed with different concentration and ink volume.

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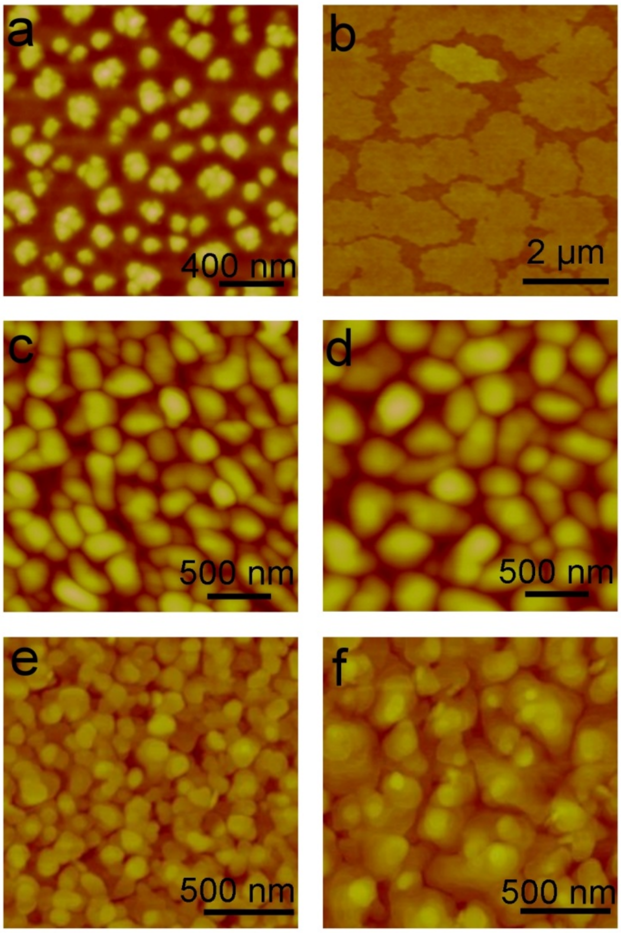

Fig. S1 (a) AFM images of 2~3 molecular layers of pentacene deposited on OTS modified SiO_2. (b) AFM images of 1~2 molecular layers of pentacene deposited on TTF–TCNQ nanoweb modified SiO_2. (c) AFM image of CuPc film on OTS modified SiO_2. (d) AFM image of pentacene film on TTF–TCNQ nanoweb modified SiO_2. (e) AFM image of tetracene film on OTS modified SiO_2. (f) AFM image of tetracene film on TTF–TCNQ nanoweb modified SiO_2.

To investigate the mechanism by buffer layer affects morphology, few molecular layers pentacene were fabricated on the different substrates. The AFM images shown in Figure S 1a, and 1b indicate that different pentacene growth mechanisms are involved for different buffer layers. Pentacene was found to grow by a formal Volmer–Weber (island) growth mode on OTS modified SiO_2. On TTF-TCNQ nanoweb, a peculiar Stranski–Krastanov growth mode was observed: the pentacene initially grew in a layer by layer mode (form large grains), and subsequently the growth transformed into an 'island' mode the monolayer grains stop growing while the second molecular layers start to grow.

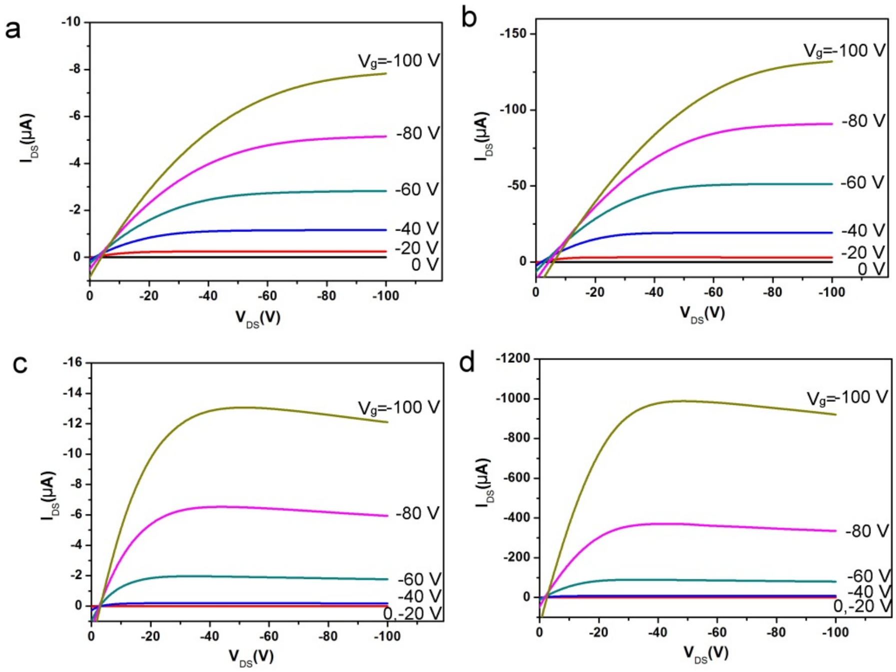

Fig. S2 (a) Output characteristic of CuPc OTS TFTs. (b) Output characteristic of CuPc TTF–TCNQ nanoweb TFTs. (c) Output characteristic of tetracene OTS TFTs. (d) Output characteristic of tetracene TTF–TCNQ nanoweb TFTs.