Supporting Information

Organic Microcrystal Array-Embedded Layer: Highly Directional Alternating p- and n-Channel for Ambipolar Transistor and Inverter

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Fig. S1 Output ($V_{GS} = 0$ V ~ -40 V) characteristic curves of OFETs based on TIPS-pentacene 1D-microwires and 480 nm thick polymer gate dielectric. The channel length ($L$) and width ($W$) of the OFET were 50 and 64 μm, respectively.
**Fig. S2** Output ($V_{GS} = 0\ \text{V} \sim 60\ \text{V}$) characteristic curves of OFETs based on a single layer of F$_{16}$CuPc (50 nm) thin-film grown by thermal evaporation on CL-PVP gate dielectric at room temperature. The channel length ($L$) and width ($W$) of the OFETs were 50 and 1000 μm, respectively.

**Morphological characteristics of F$_{16}$CuPc film deposited on and in between the TIPS-pentacene microwires.**

AFM images of the F$_{16}$CuPc film deposited on and in between 1D-microwires of TIPS-pentacene are shown in Fig. S3. This figure shows the topology of F$_{16}$CuPc deposited on 1D-microwires of TIPS-pentacene [Fig. S3(a)] and in between the microwires [Fig. S3(b)]. Figures also show that the grain sizes of the deposited F$_{16}$CuPc on 1D-microwires are smaller in comparison to the grain sizes deposited in between 1D-microwires. The average and rms roughness of F$_{16}$CuPc film deposited on 1D-microwires are 0.875 and 1.105 nm, respectively. The average and rms roughness of F$_{16}$CuPc film deposited in between the 1D-microwires are 0.921 and 1.161 nm, respectively.
Fig. S3 (a) AFM images (2 x 2 μm²) of F₁₆CuPc film grown on 1D-microwires of TIPS-pentacene at 25 °C; (b) AFM images of F₁₆CuPc film grown on polymer gate dielectric (in between the microwires) at 25 °C.

Fig. S4 Output curves of the CMOS-like inverter based on two ambi-OFETs based on alternating p- and n-channel along with the schematic diagram of the logic circuit and optical microscopic image of the channel region of both OFETs. Output characteristics of ambi-OFETs swept from $V_{DS}$ 0 V to 60 V with an increment of 1 V with an applied constant $V_{GS}$ from 0 V to 80 V (increment of 10 V). Similarly, output characteristics of ambi-OFETs were measured by sweeping from $V_{DS}$ 0 V to -60 V (increment of 1 V) with an applied constant $V_{GS}$ from 0 V to -80 V (increment of -10 V).
Fig. S5 (a) Output and (b) transfer characteristics of the ambi-OFET used in load type inverter.

Fig. S6 The transient response of PMOS with a resistive load of 20 MΩ at constant drain bias when the gate voltage is pulsed at (a) 1 Hz, (b) 5 Hz, (c) 20 Hz and (d) 30 Hz.
Fig. S7 The transient response of NMOS with a resistive load of 20 MΩ at constant drain bias when the gate voltage is pulsed at (a) 1 Hz, (b) 5 Hz, and (c) 20 Hz.