Electronic Supplementary Information (ESI)

Effect of Access Resistance on Temperature-Carrier Mobility Dependence in High-Crystalline DNTT-Based Transistors

Qijing Wang, Sai Jiang, Yi Shi,* and Yun Li*

[†]National Laboratory of Solid-State Microstructures, School of Electronic Science and Engineering,

Collaborative Innovation Center of Advanced Microstructures, Nanjing University, Nanjing 210093, P. R. China

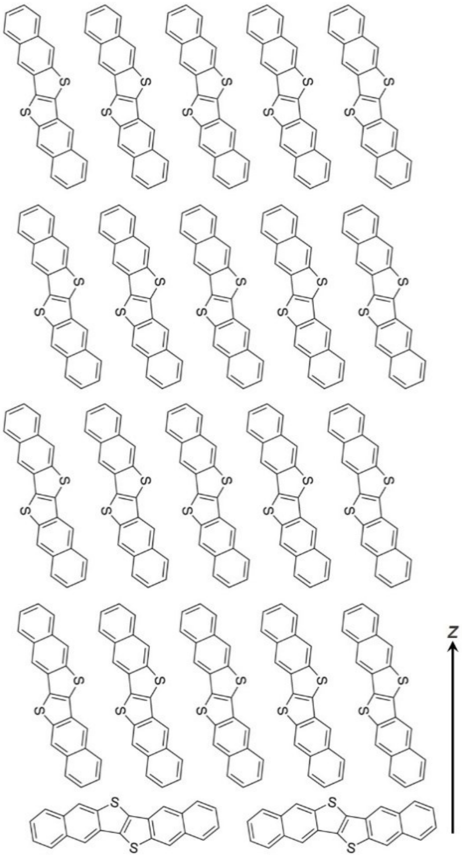

Figure S1. Schematic illustration of the molecular packing of the evaporated DNTT films.

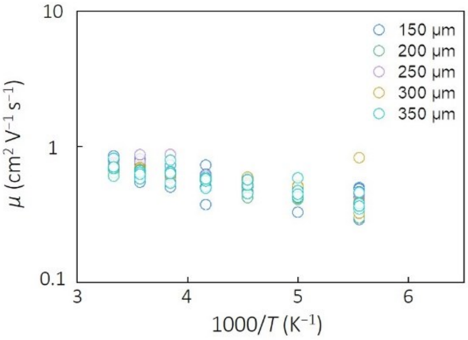

Figure S2. Field-effect mobility of slow- evaporated DNTT transistors with L > 100 µm as a function of temperature.

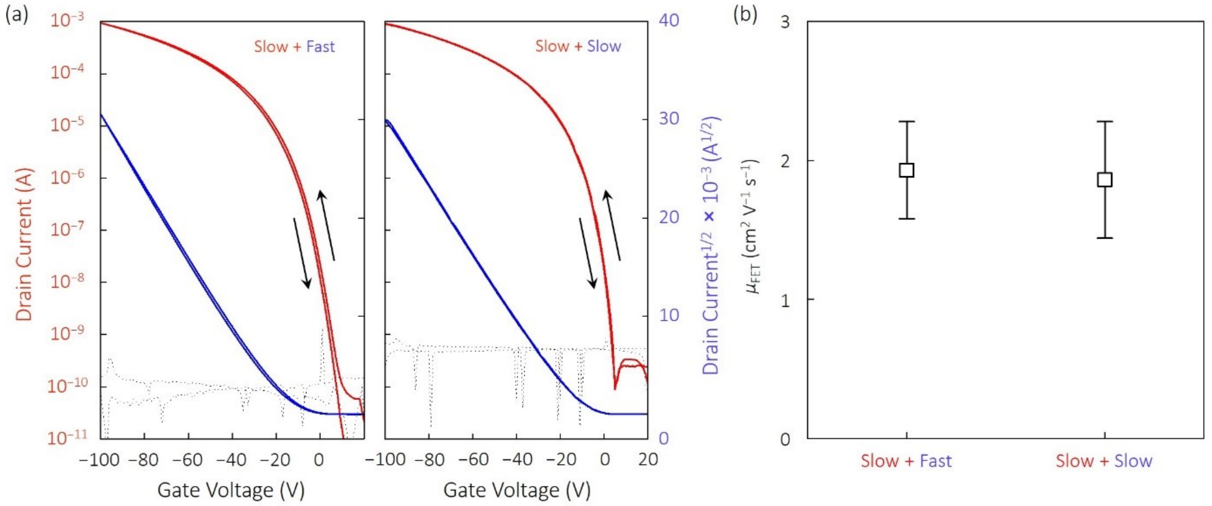

Figure S3. (a) Transfer characteristics at a drain voltage of −100 V of OFETs based on the 20 nm-thick DNTT films deposited by fast (left) and slow (right) evaporation, respectively. (b) The carrier mobility of OFET samples based on both evaporated DNTT films. The temperature of these measurements was 300 K.

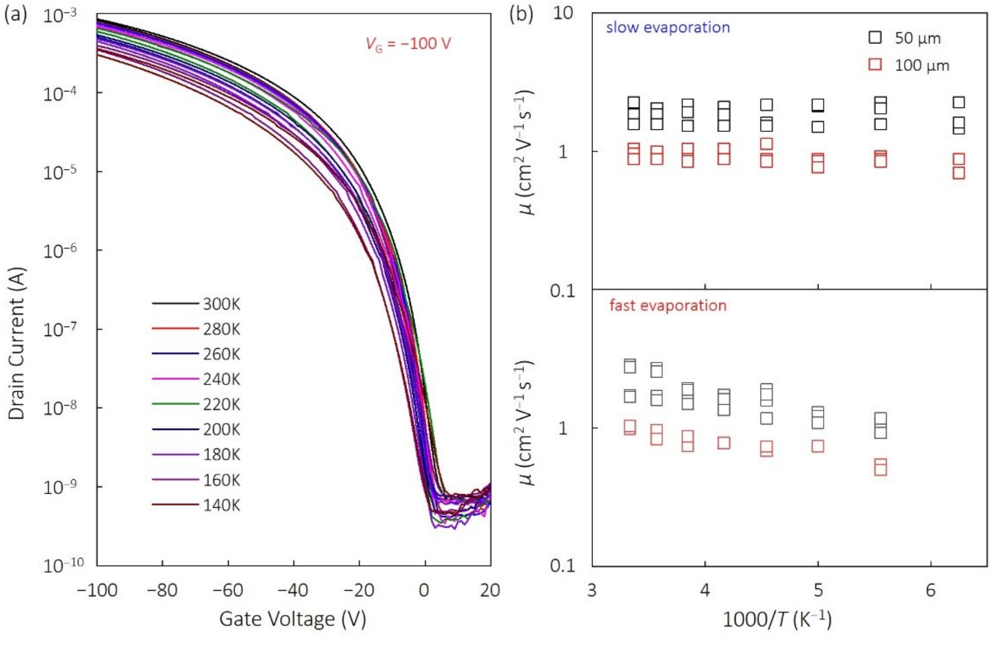

Figure S4. (a) Temperature-dependent electrical property of DNTT transistors based on fast-evaporated DNTT films. (b) Field-effect mobility of slow- and fast-evaporated DNTT transistors as a function of temperature. Channel width is 500 μm and channel length are 50 μm (black square) and 100 μm (red square), respectively.

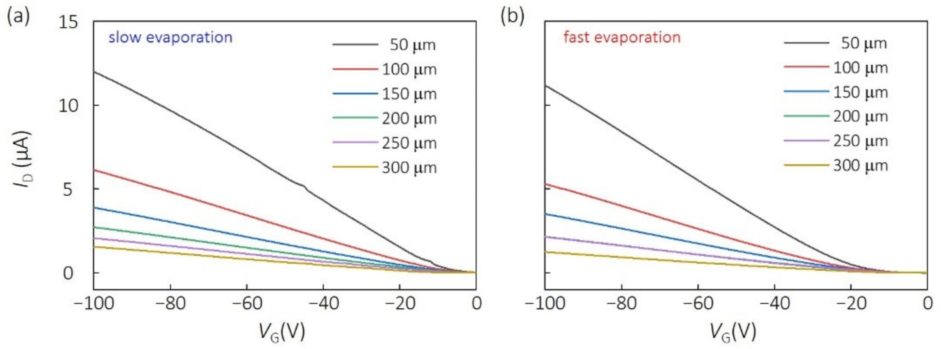

Figure S5. Typical transfer characteristics of the 20 nm-thick (a) slow- and (b) fast-evaporated DNTT-based devices at $V_{\mathrm{G}} = -1$ V at room temperature. The channel length varies from 50 to 300 μm for TLM analysis, and the channel width is fixed at 500 μm.

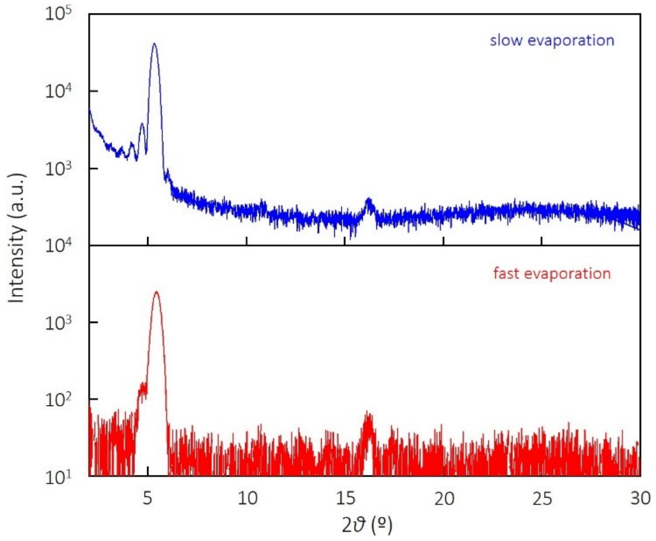

Figure S6. XRD patterns on a logarithmic scale of (up) slow- and (bottom) fast-evaporated 20 nm-thick DNTT films. The peaks at 2ϑ = 5.31º and 5.43º in these samples both correspond to the (*001*) peak.

Table S1. Characteristics of OFETs based on fast- and slow-evaporated DNTT films on SiO_2 dielectric in saturation regime.

Semiconducting layer	μ_{FET} (cm^2 V^{-1} s^{-1})	On/off	V_T (V)	SS (V dec^{-1})	N_{trap} ($\times 10^{12}$ cm^{-2})
Fast-evaporated	1.93	10^6	−18.7	3.89	4.62
Slow-evaporated	2.04	10^6	−18.9	2.18	2.56

Note S1: A nearly linear increase in the small range of drain voltage (V_D = 0 ~ −10 V) in the output curves was clearly observed. This feature was considered as the sign of a nearly Ohmic contact with an efficient charge injection at the Au/DNTT interface. However, based on our previous work, we found that this feature was often observed when the contact resistance is much lower than that of the channel resistance. On the other hand, although the work function of Au (~5.1 eV) is close to the HOMO of DNTT (~5.2 eV), the energy level mismatch between these two materials still needs to be determined by the Au/DNTT interface property, since the many external factors (e.g. the deposition of the metal contacts by thermal evaporation has complex effects on the Φ_B due to the formation of interface dipoles and/or the generation of gap states) influence the energy barrier.