Electronic Supplementary Information

Ionic Liquid Thin Layer-Induced Memory Effects in Organic Field-Effect Transistors

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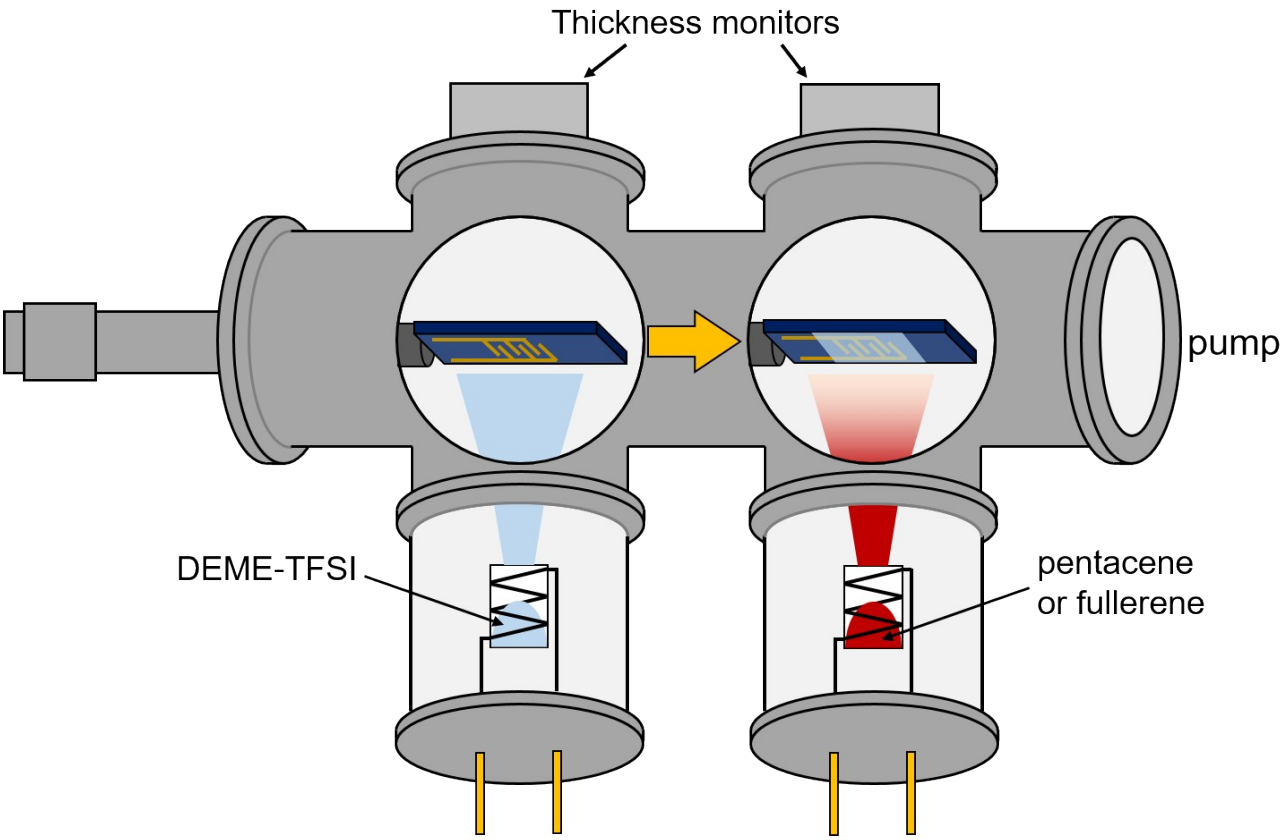

Figure S1. Sample preparation and *in situ* FET measurements under high vacuum conditions (base pressure of 5×10^{-5} Pa). DEME-TFSI, pentacene, and fullerene were deposited onto the FET substrates with deposition rates of ~0.2 ML min^{-1} for DEME-TFSI and pentacene, and of ~0.4 ML min^{-1} for fullerene, using thickness monitors.

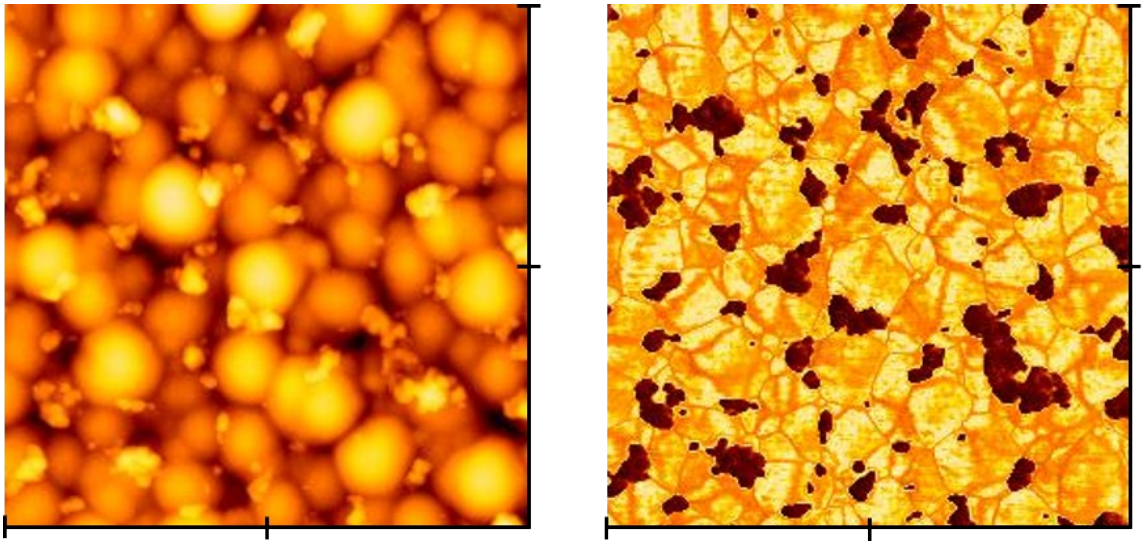

Figure S2. Topological AFM image (left) and the corresponding phase image (right) of a fullerene thin film (20 ML), prepared on 5 ML DEME–TFSI. The area shown in the images, is 1 × 1 μm^2.

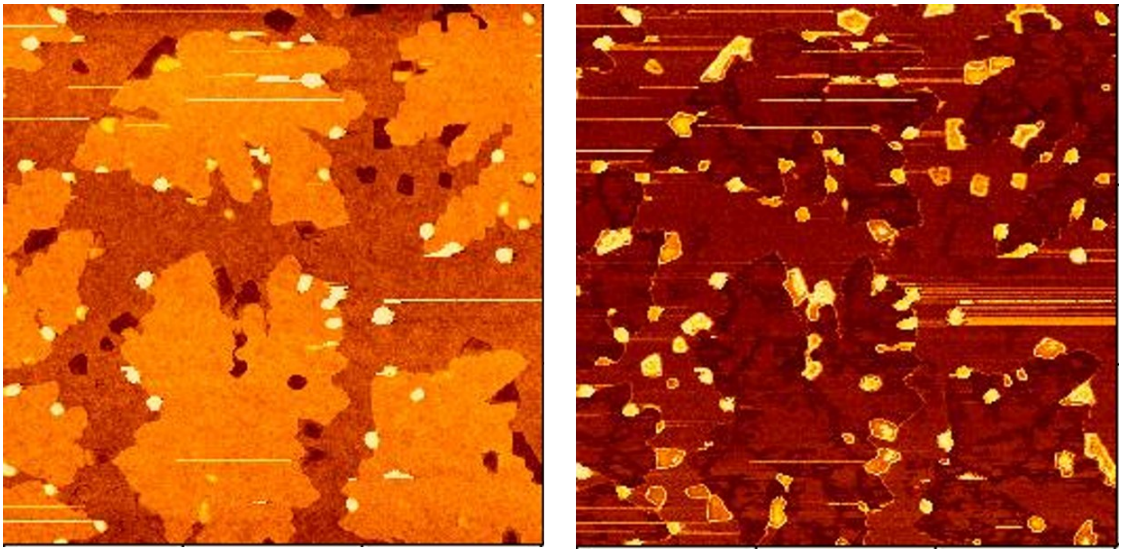

Figure S3. Topological AFM image (left) and the corresponding phase image (right) of DEME–TFSI deposited on a pentacene thin film (1.5 ML) prepared on a bare SiO_2 surface. The area shown in the images, is 3 × 3 μm^2.

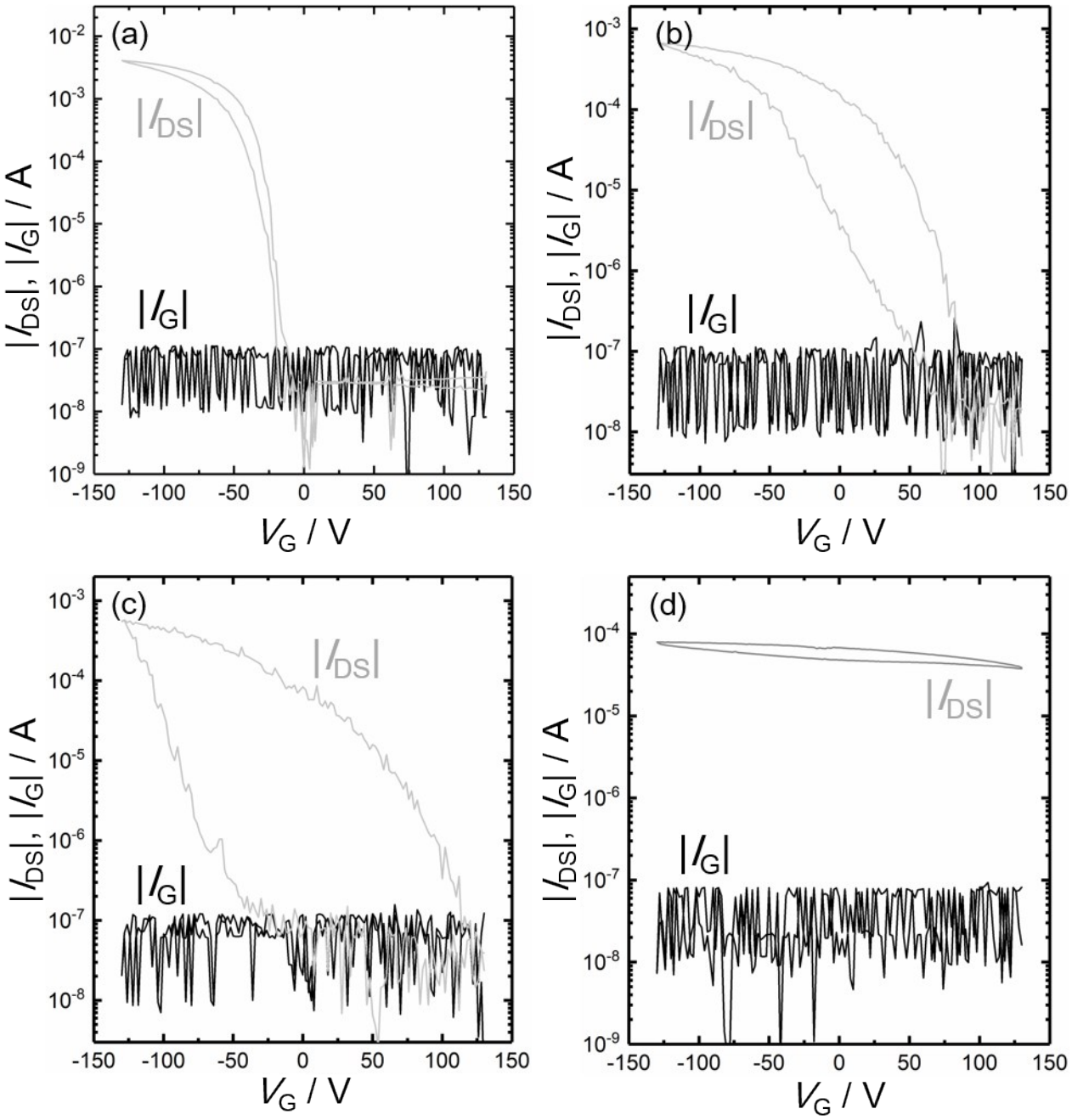

Figure S4. Gate leakage current (I_G) in the transfer characteristics of the pentacene FETs with (a) 0 ML, (b) 1 ML, (c) 2 ML, and (d) 5 ML DEME–TFSI, measured at V_{DS} = –20 V in the dark.

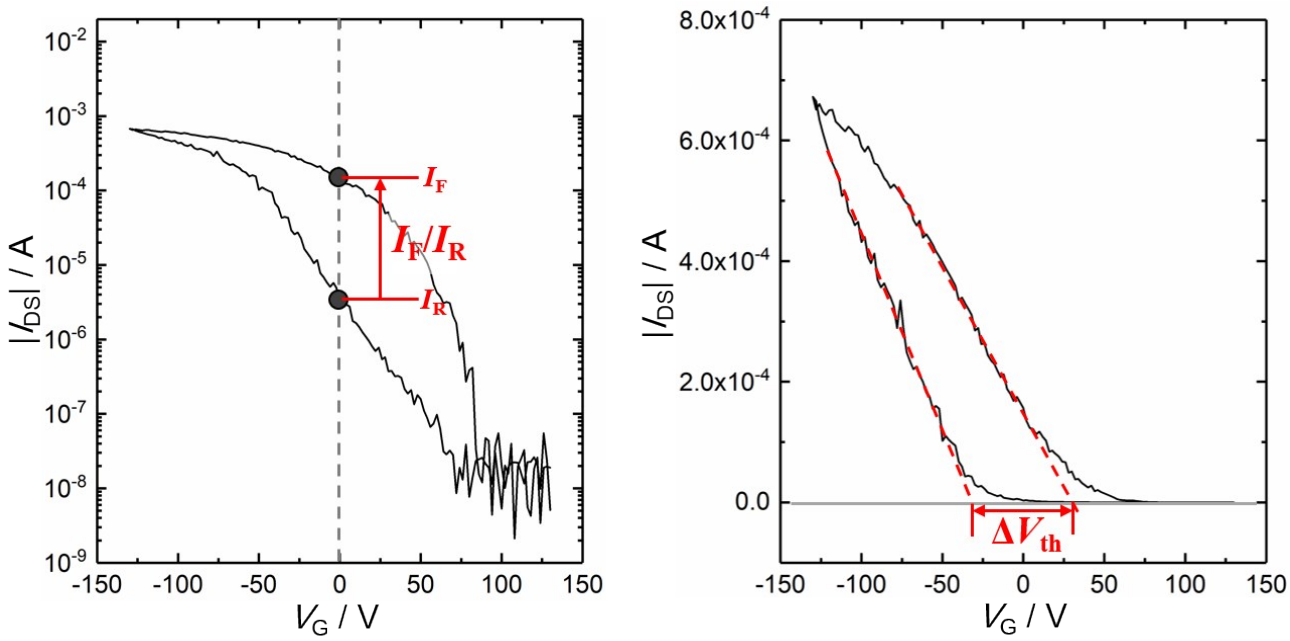

Figure S5. Extraction of the field-effect mobility (μ_{FET}), memory-ratio (I_F/I_R), and memory-window (ΔV_{th}) parameters from the transfer characteristics. The μ_{FET} and V_{th} values were calculated with the standard equation in the linear regime, $I_{DS} = (W/L)\mu_{FET}C_iV_{DS}(V_G - V_{th} - V_{DS}/2)$, described in K. Hagen, *Chem. Soc. Rev*. **39**, 2643−2666, 2010, where C_i is the capacitance per unit area of the insulating layer.

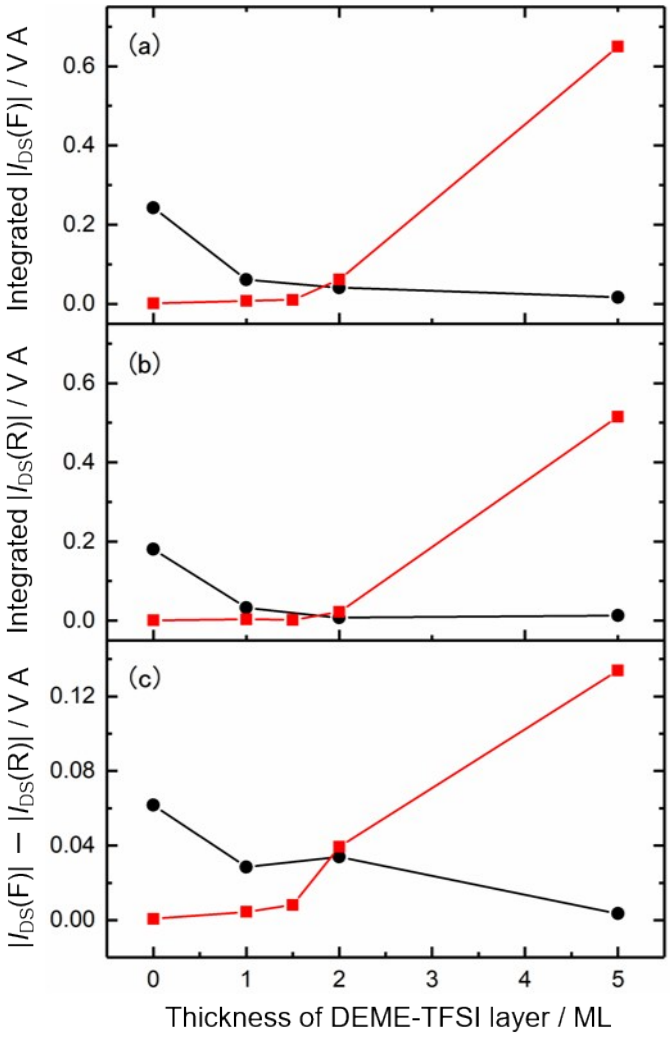

Figure S6. Integrated values of $|I_{DS}(F)|$ and $|I_{DS}(R)|$ and their differences calculated for the pentacene (black) and C_{60} (red) FETs with DEME-TFSI layers, using equation (2) in the main text.

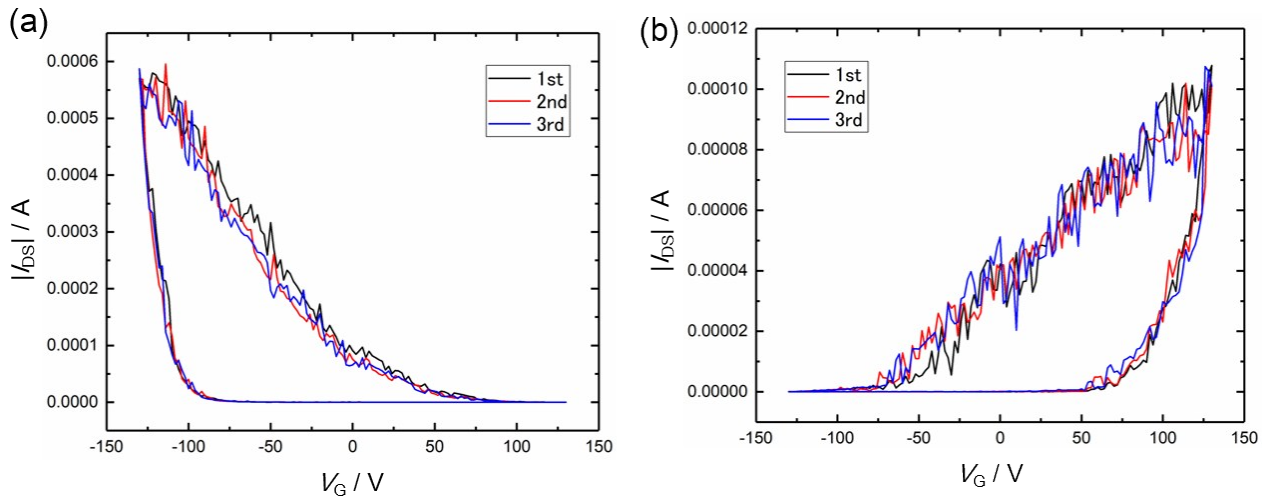

Figure S7. Transfer characteristics of (a) pentacene (IL: 2 ML) and (b) C_{60} (IL: 1.5 ML) devices for three cycles.

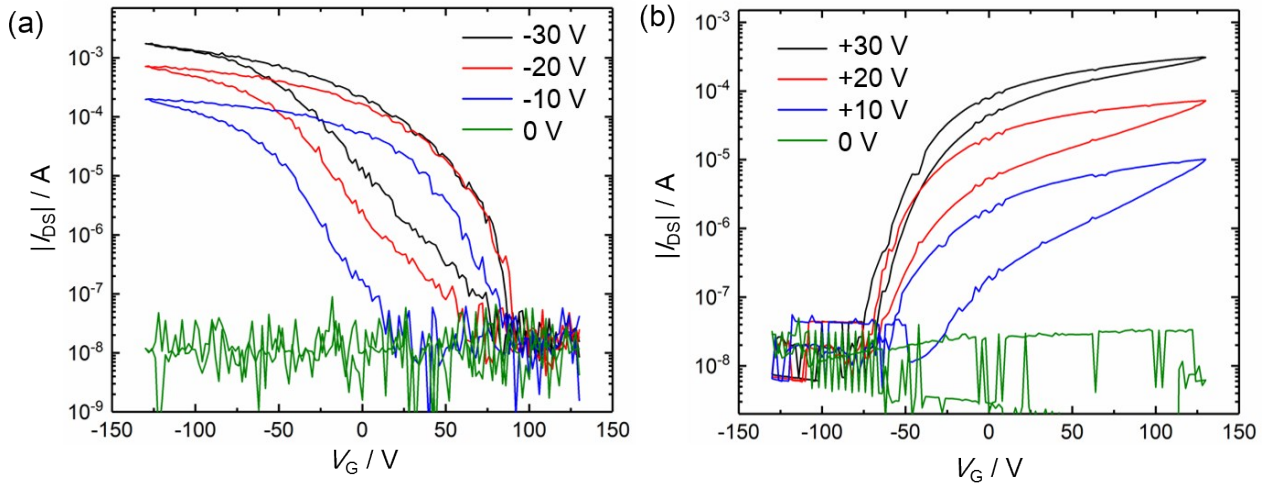

Figure S8. Transfer characteristics of (a) pentacene and (b) C_{60} FETs with 1 ML DEME-TFSI, measured at (a) V_{DS} = 0, -10, -20, and -30 V and (b) V_{DS} = 0, +10, +20, and +30 V.