Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Electronic Supplementary Information

for

Individual and synergetic charge transport properties at the solid and electrolyte interfaces of a single ultrathin single crystal of organic semiconductors

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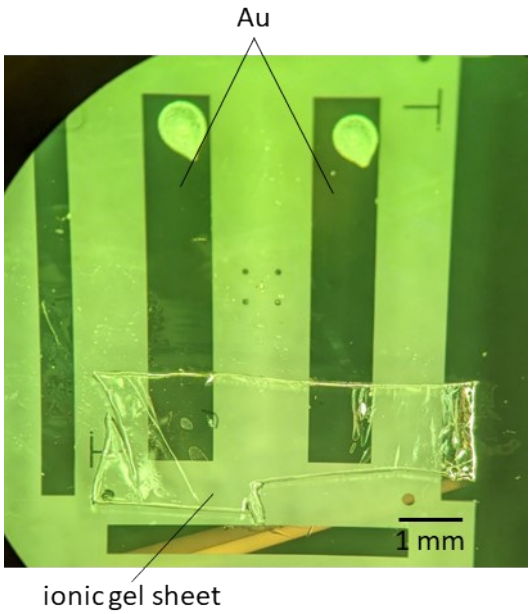

Fig. S1 Micrograph of the device of capacitance measurement for ionic gel.

Estimation of contact resistance by four-probe method

Contact resistance measurements employ the four-probe transistor architecture as shown in Fig. 2d in the main text as well as in Fig. S2a below, according to the reported method.[1] The in-channel potential probes along the longitudinal direction were placed 50 μm (x_1) and 100 μm (x_2) from the source electrode, with $V(x_1)$ and $V(x_2)$ being the potentials at the respective voltage probes, while the distance between source and drain electrodes was 150 μm. In the linear (Ohmic) regime, the potential profile from the source to the drain electrodes along the channel direction is approximated to be linear. Meanwhile, the voltage drops at respective electrodes ($\Delta V_{C,S}$ and $\Delta V_{C,D}$ for source and drain contacts, respectively) due to contact resistance. $\Delta V_{C,S}$ and $\Delta V_{C,D}$ are extracted by extrapolation of the potential profile to $x = 0$ and L as shown in Fig. S2b. In our experiments, $\Delta V_{C,S}$ and $\Delta V_{C,D}$ were extracted at $V_{BG} = -50$ V as shown in Fig. S2c, where the data at $V_{SG} = -1.4$ and 2.0 V are shown as the representative. Because a drain current I_D is constant at source and drain contacts and within the channel due to charge conservation, R_S and R_D are calculated as $\Delta V_{C,S} I_D$ and $\Delta V_{C,D} I_D$, respectively. Finally, R_S and R_D are normalized by channel width W to be $R_S W$ and $R_D W$ because the resistance is dependent on dimensions of a conductor.

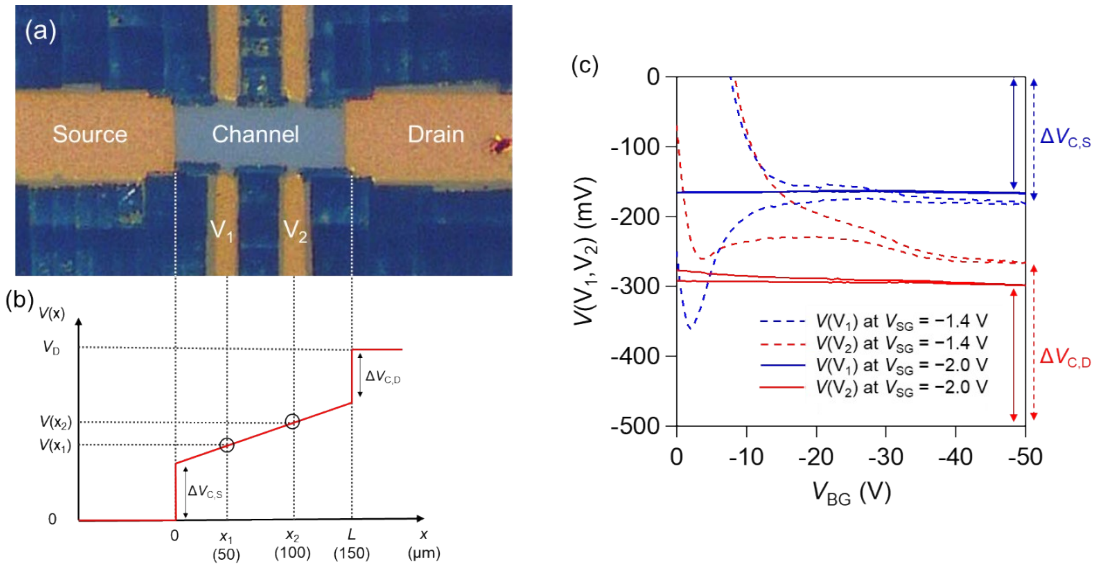

Fig. S2 (a) Optical microscopy image of a four-probe transistor architecture. (b) Schematic potential diagram. (c) Traces of in-channel potentials at probes V_1 and V_2 as a function of V_{BG} at $V_{SG} = -1.4$ and 2.0 V.

Supplementary References

1 A. Yamamura, S. Watanabe, M. Uno, M. Mitani, C. Mitsui, J. Tsurumi, N. Isahaya, Y. Kanaoka, T. Okamoto and J. Takeya, *Sci. Adv.*, 2018, **4**, eaao5758.