

High Synaptic Plasticity Enabled by Controlled Ion Migration in Organic Heterojunction Memristors

Yangzhou Qian,^a Jiayu Li,^{ab} Wen Li,^{*a} Cheng-Hung Hou,^c Ziyi Feng,^a Wei Shi,^{*d}
Mingdong Yi^{*a}

^a *State Key Laboratory of Organic Electronics and Information Displays, Jiangsu Key Laboratory for Biosensors, Institute of Advanced Materials (IAM), Nanjing University of Posts & Telecommunications (NUPT), Nanjing 210023, China*

^b *College of Electronic and Optical Engineering & College of Flexible Electronics (Future Technology), Jiangsu Province Engineering Research Center for Fabrication and Application of Special Optical Fiber Materials and Devices, Nanjing University of Posts and Telecommunications (NUPT), Nanjing 210023, China*

^c *Research Center for Applied Sciences Academia Sinica Taipei 11529, Taiwan*

^d *Key Laboratory of Flexible Electronics and Institute of Advanced Materials, Nanjing Tech University, Nanjing 211816, China*

*Correspondence: iamwli@njupt.edu.cn, iammdyi@njupt.edu.cn,
iamwshi@njtech.edu.cn

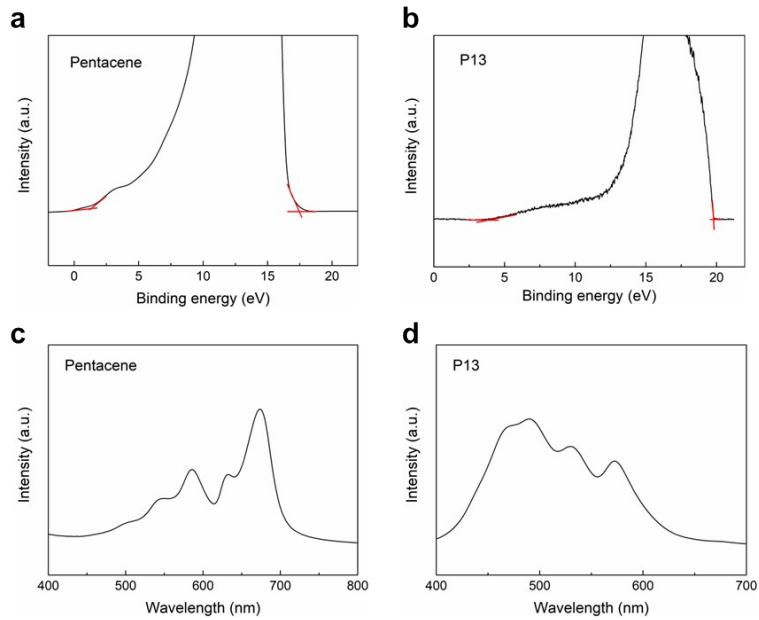


Fig. S1 UPS spectra of pentacene (a) and P13 (b); UV vis spectra of pentacene (c) and P13 (d).

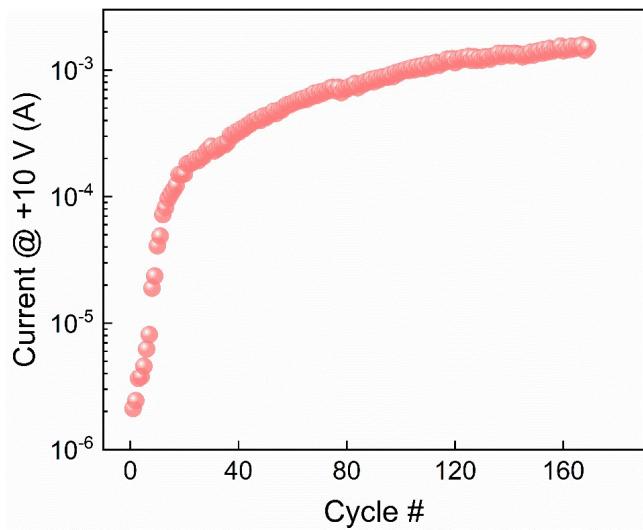


Fig. S2 The current values at the end of each scan, up to 160 cycles of I - V curve scanning, with a gradual increase in current values.

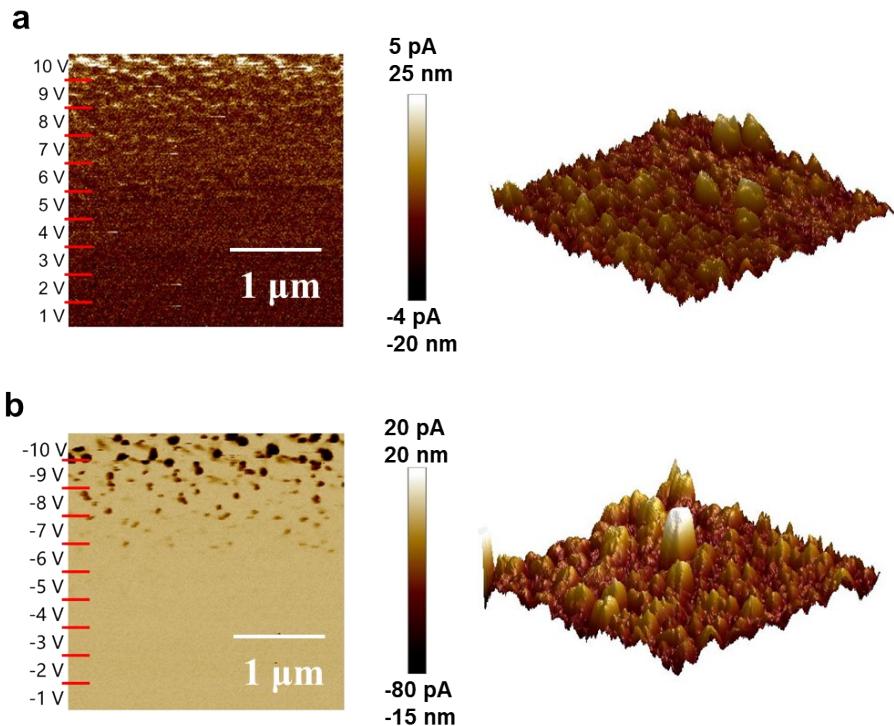


Fig. S3 c-AFM measurements of OHM. Current mappings of heterojunction film under voltage sweep of $+1\text{ V} \rightarrow +10\text{ V}$ (a) and $-1\text{ V} \rightarrow -10\text{ V}$ (b).

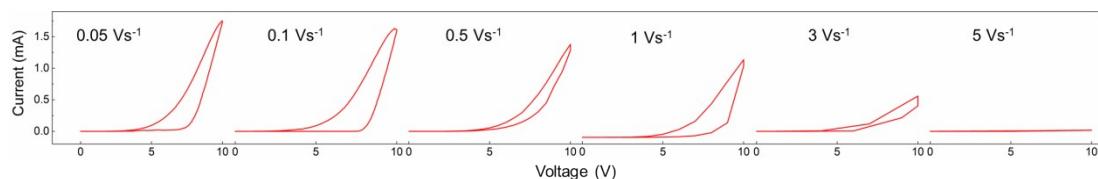


Fig. S4 The scan rate dependence I - V characteristics for OHM. Scan rates: $0.05\text{--}5\text{ Vs}^{-1}$.

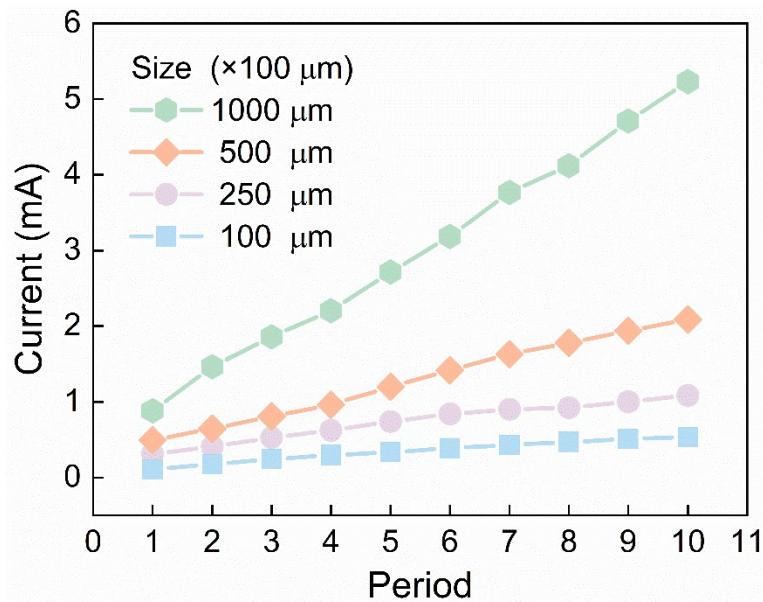


Fig. S5 The area-dependence I - V characteristics for OHM. Device area: $100 \times 100 \mu\text{m}^2$ – $1000 \times 100 \mu\text{m}^2$.

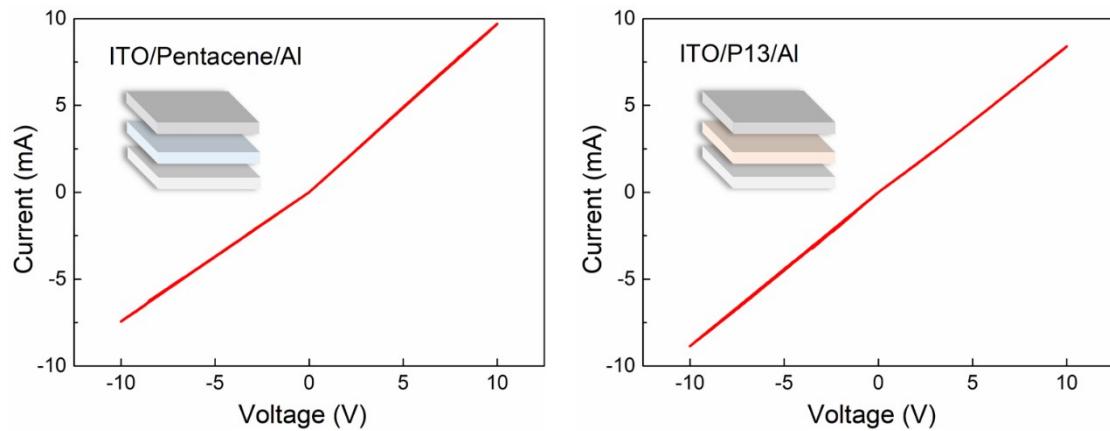


Fig. S6 I - V curves of single layer pentacene and P13 devices.

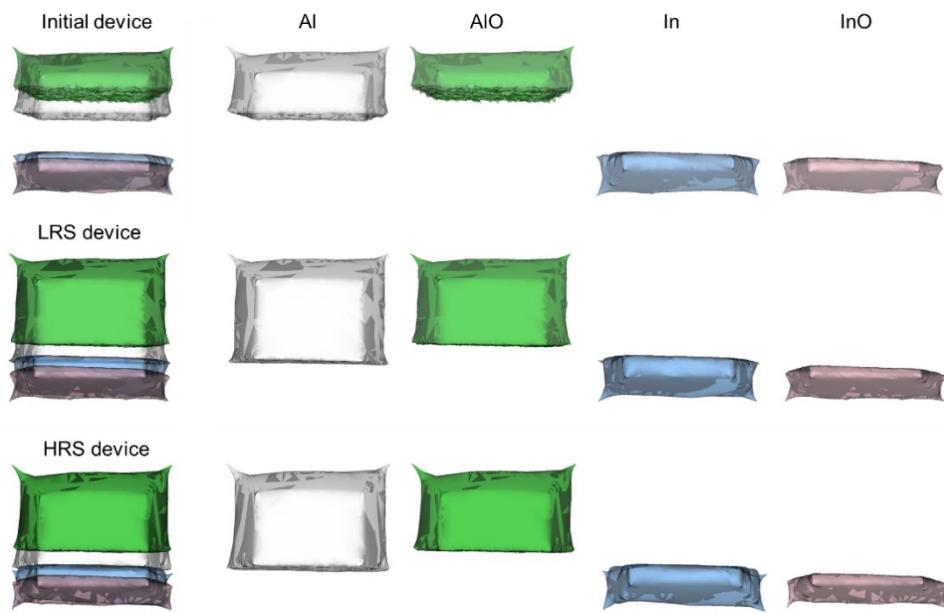


Fig. S7 ToF-SIMS 3D images of each element in the OHM in initial state, LRS, and HRS.

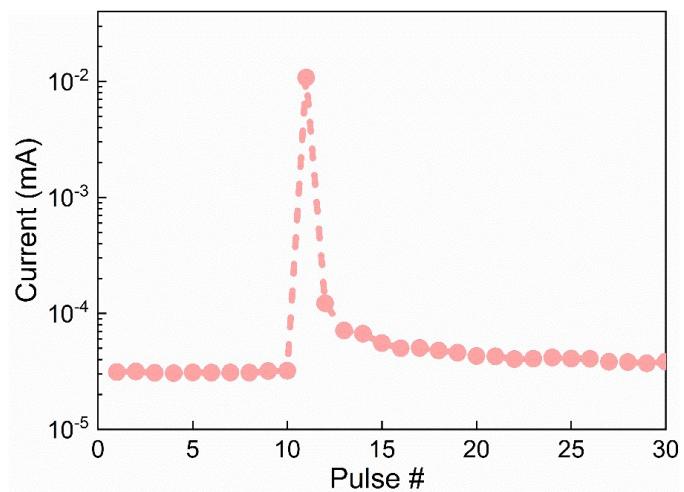


Fig. S8 The OHM simulates EPSC behavior.

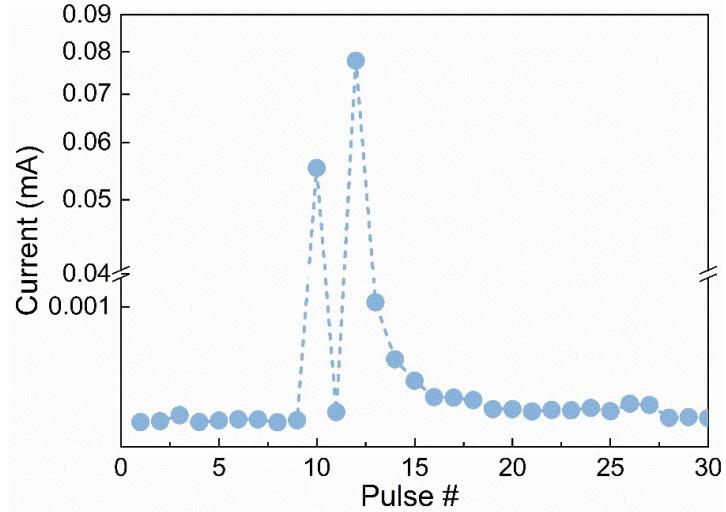


Fig. S9 The OHM simulates PPF behavior.

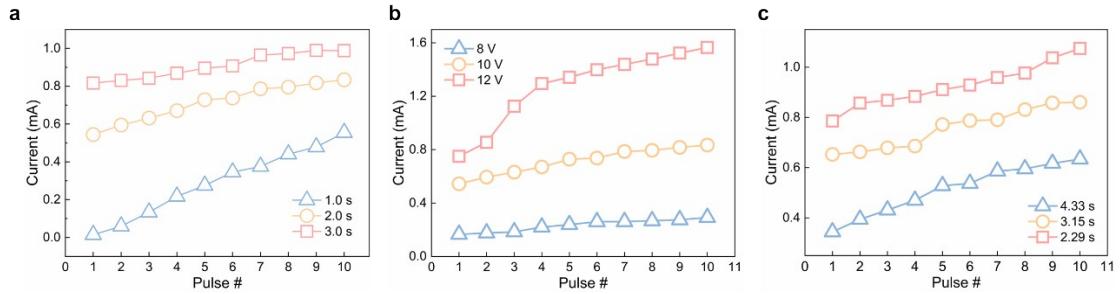


Fig. S10 Effects of different pulse parameters, including (a) pulse width, (b) pulse amplitude, and (c) pulse interval on the current (synaptic weight) of OHM.

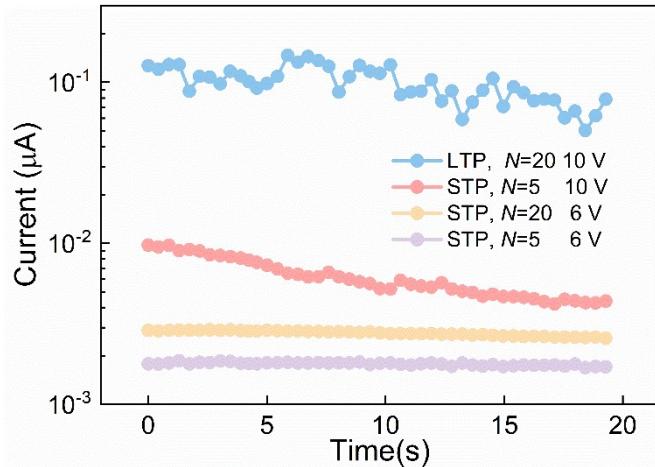


Fig. S11 A series of pulses with varying amplitudes and numbers to achieve corresponding levels of relaxation currents in the device, obtaining distinct STP and LTP.

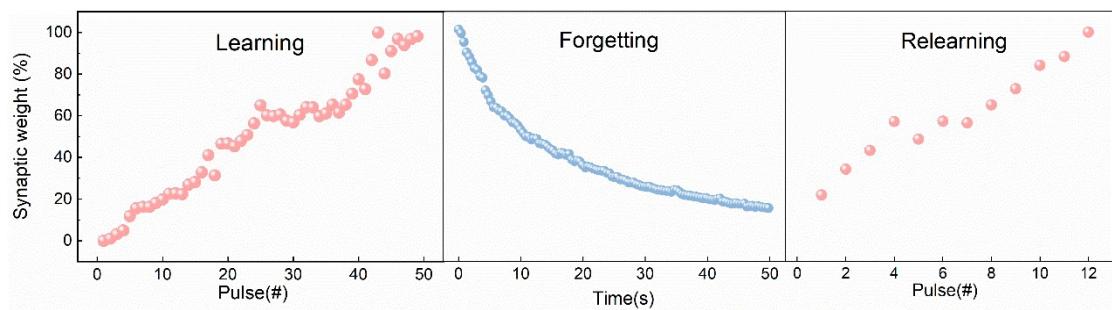


Fig. S12 The learning-forgetting-relearning process simulated in the OHM.