

Supplementary Material

Graphene/F₁₆CuPc synaptic transistor for the emulation of multiplexed neurotransmission

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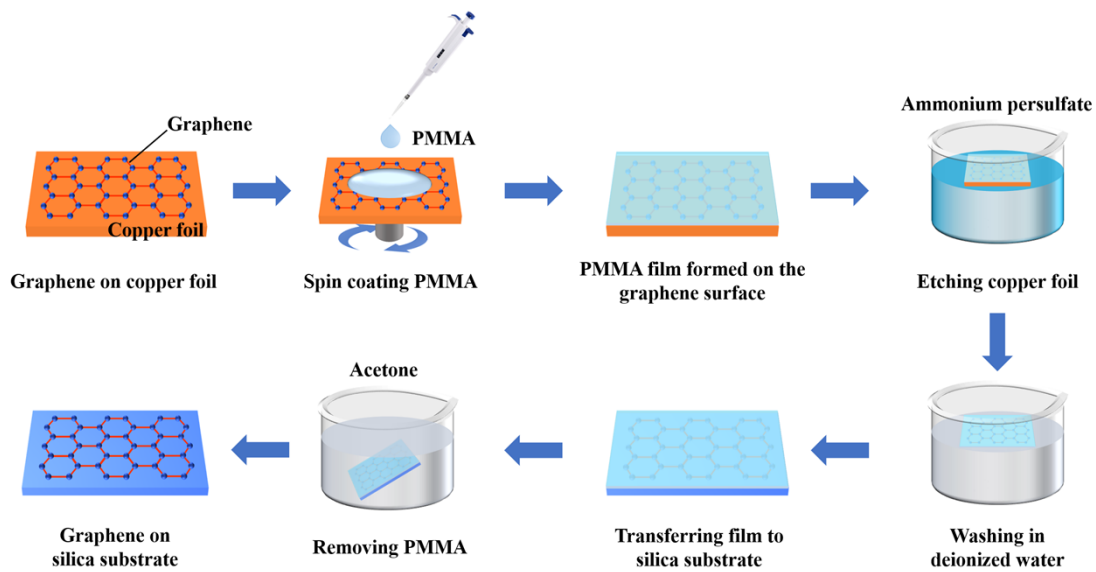


Fig. S1. (Color online) Schematic diagram of graphene transfer process based on PMMA-assisted method.

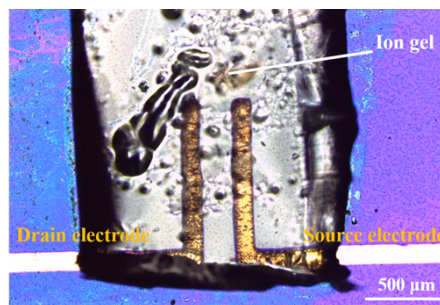


Fig. S2. (Color online) Optical microscope photograph of GFST. The channel length and width of GFST are 200 μm and 1000 μm , respectively.

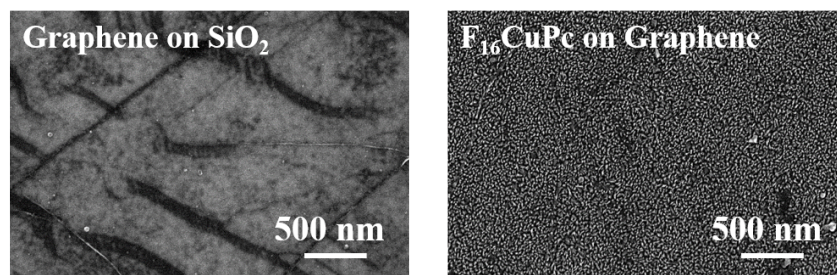


Fig. S3. (Color online) SEM images of graphene and graphene/ F_{16}CuPc .

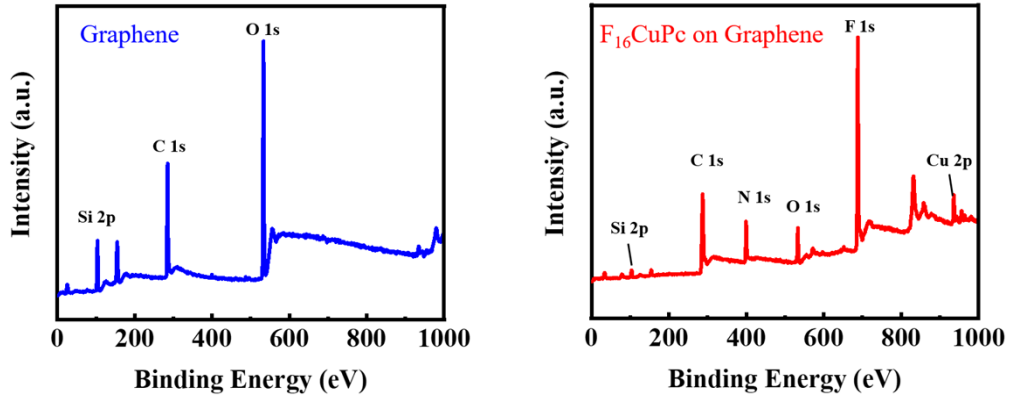


Fig. S4. (Color online) XPS spectra of graphene and graphene/F₁₆CuPc films.

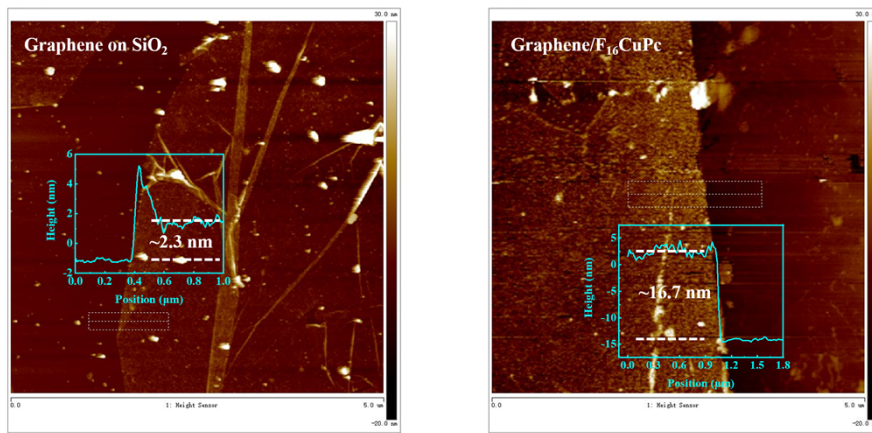


Fig. S5. (Color online) The thicknesses of graphene and graphene/F₁₆CuPc.

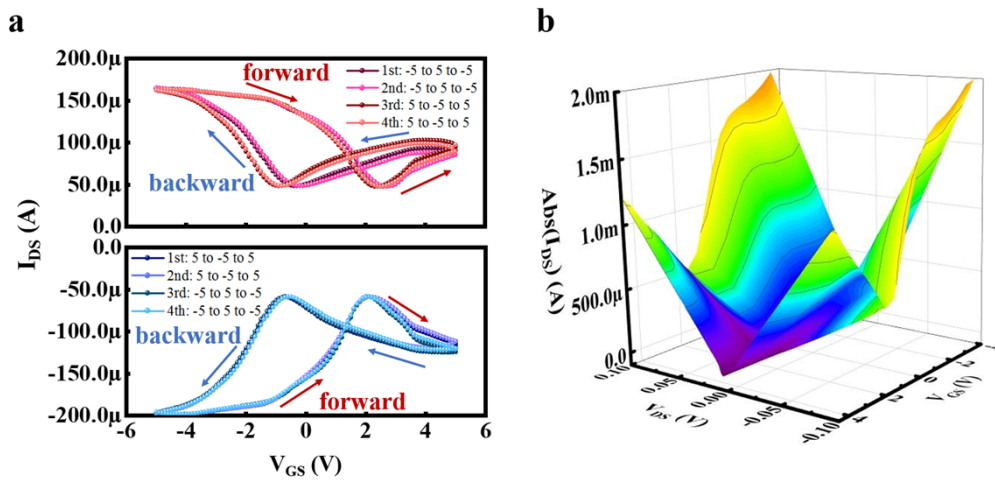


Fig. S6. (Color online) (a) Transfer curves of graphene synaptic transistor under different sweep direction, under $V_{DS} = \pm 0.01$ V. (b) The output curves of graphene synaptic transistor.

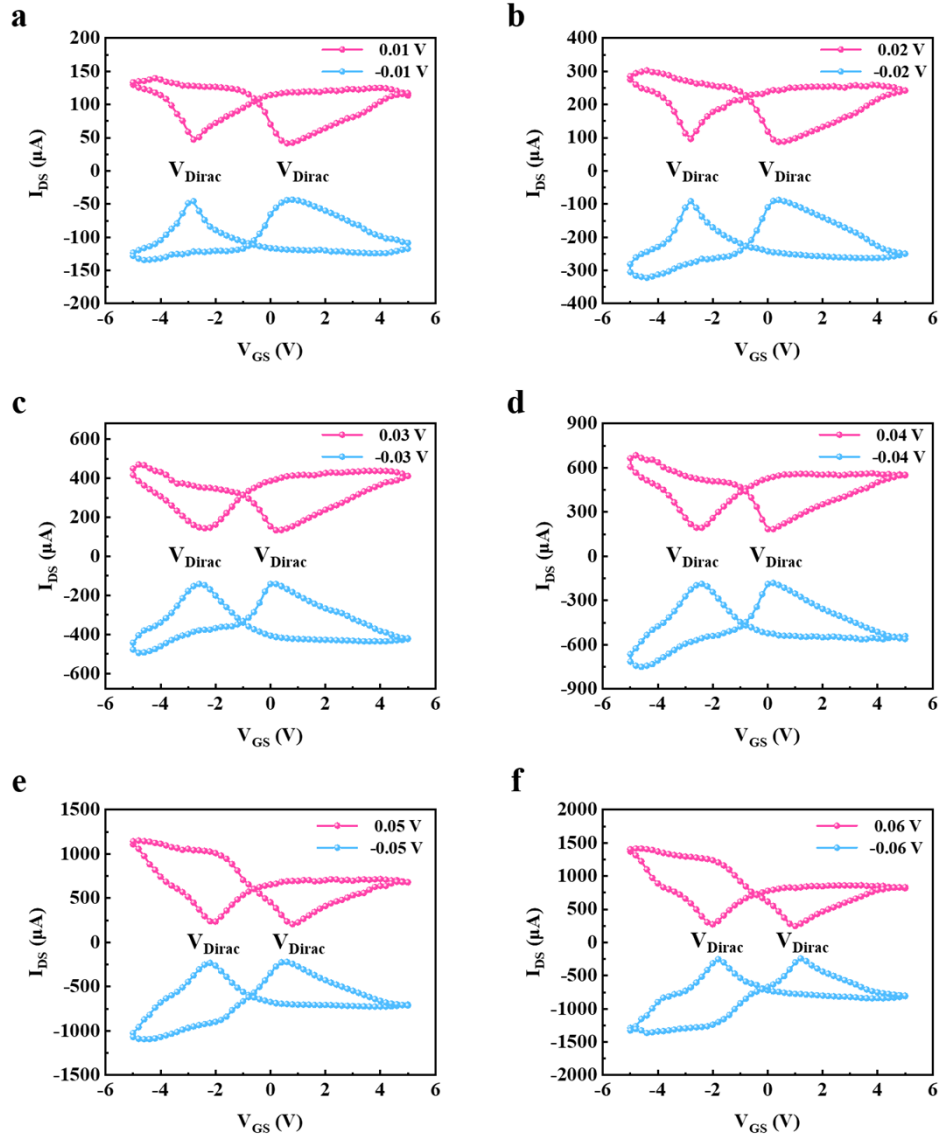


Fig. S7. (Color online) Transfer curves with V_{DS} increasing from ± 0.01 to ± 0.06 V.

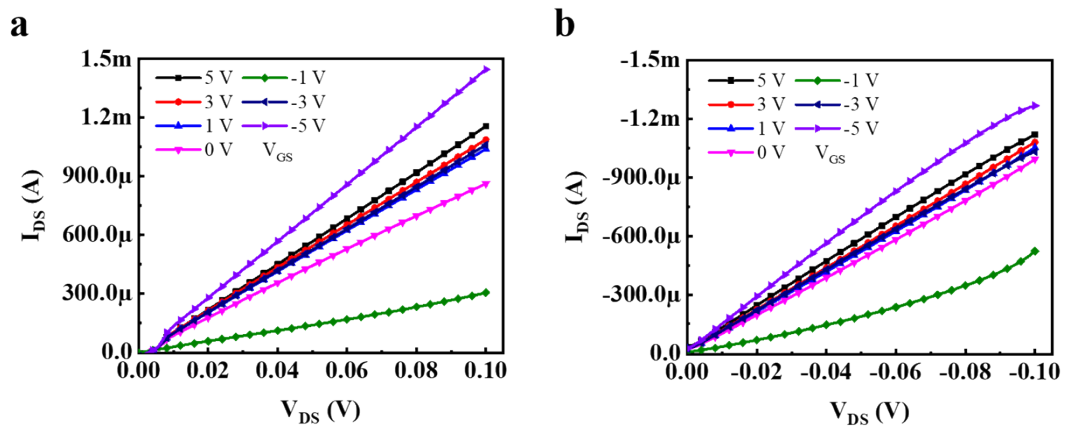


Fig. S8. (Color online) Output curves of GFST at different polarities of V_{DS} , with V_{GS} sweeping from +5 V to -5 V.

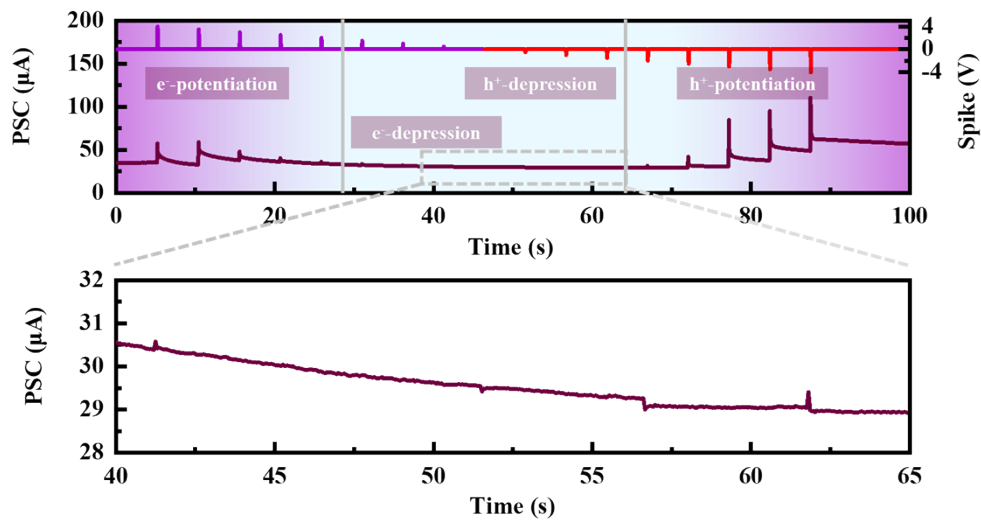


Fig. S9. (Color online) The emulation of selective release of two excitatory neurotransmitters, the V_{DS} is +0.01 V.

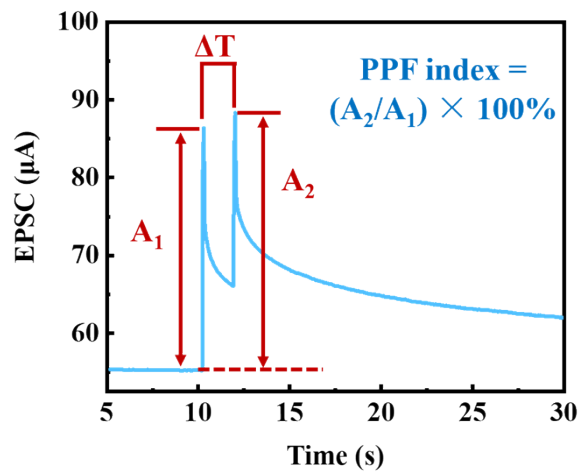


Fig. S10. (Color online) Definitions of A_1 and A_2 in PPF and the equation for calculating the PPF index.

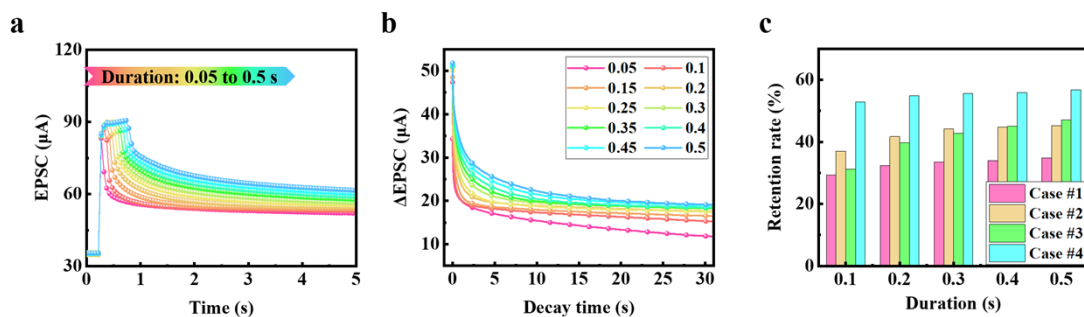


Fig. S11. (Color online) (a) SDDP of GFST. The durations of spike gradually increased from 0.05 to 0.5 s. (b) The decay trend of Δ EPSC within 30 s after triggered by external spikes with different durations. (c) The retention rate of EPSC within 30 s after triggered by external spikes with different

durations in four cases.

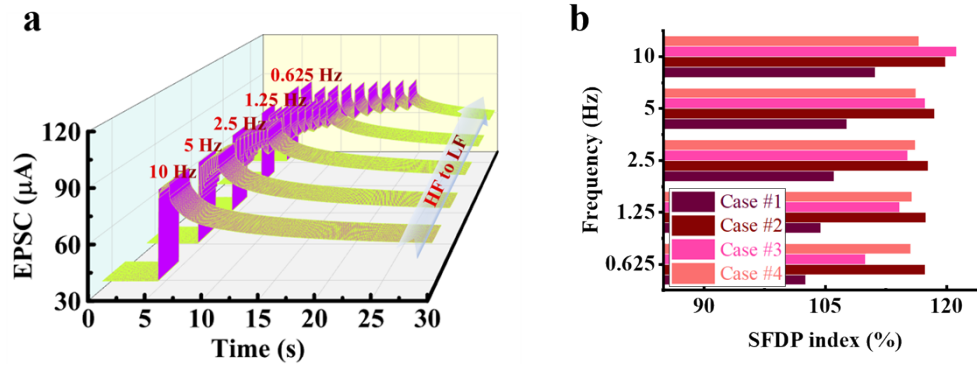


Fig. S12. (Color online) (a) SFDP of GFST. (b) SFDP index under four cases. SFDP index was defined as $(A_{10}/A_1) \times 100\%$, where A_{10} and A_1 are the peak values of EPSC triggered by the tenth and the first spikes, respectively.

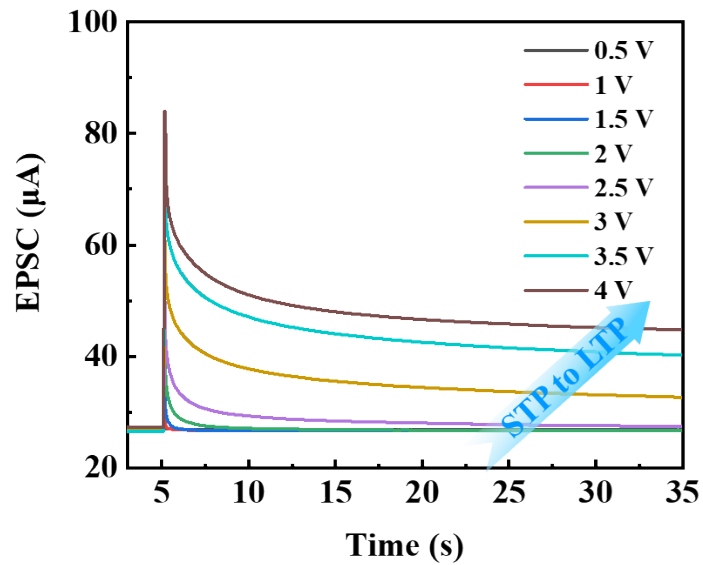


Fig. S13. (Color online) The transition from short-term plasticity to long-term plasticity was achieved with GFST by increasing the amplitude of the spikes. Where the V_{DS} was +0.01 V.

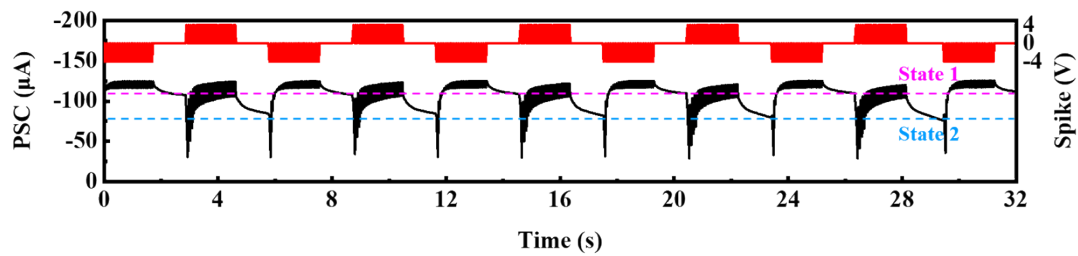


Fig. S14. (Color online) The fast switching of two different synaptic plasticities of GFST under $V_{DS} = -0.01$ V.

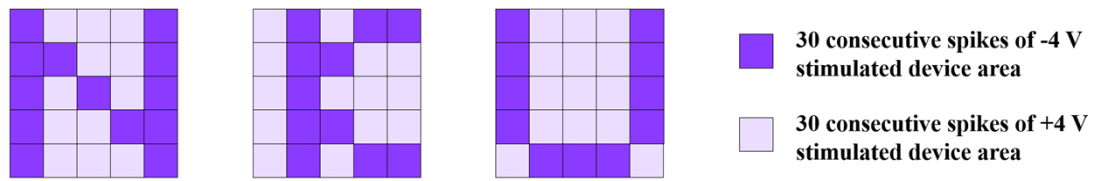


Fig. S15. (Color online) The design of the three letters “NKU” respectively in the 5×5 synaptic device array, where the purple and lavender regions are the locations of the -4 V and $+4$ V spike stimuli, respectively.

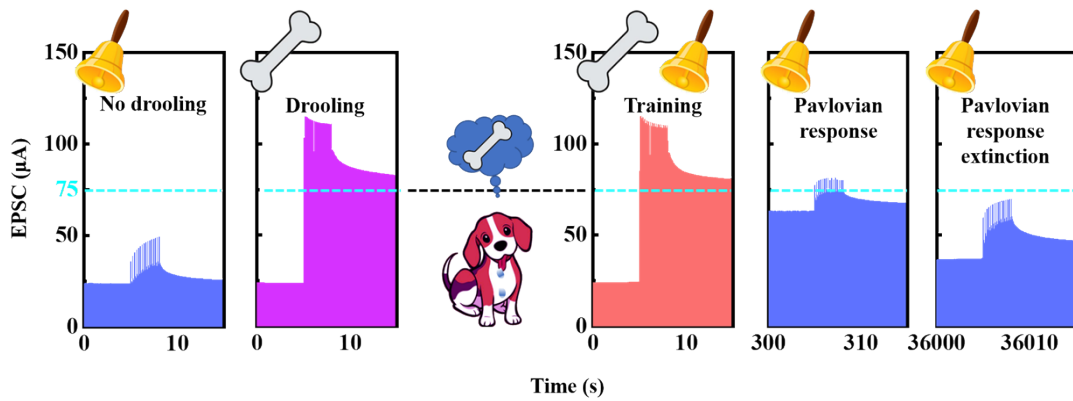


Fig. S16. (Color online) Simulation of Pavlov's dog experience learning based on GFST.