Electronic Supplementary Material (ESI) for Nanoscale.

Supplementary Information

Reversible uptake and release of sodium ions in layered SnS_2-reduced graphene oxide composites for neuromorphic devices

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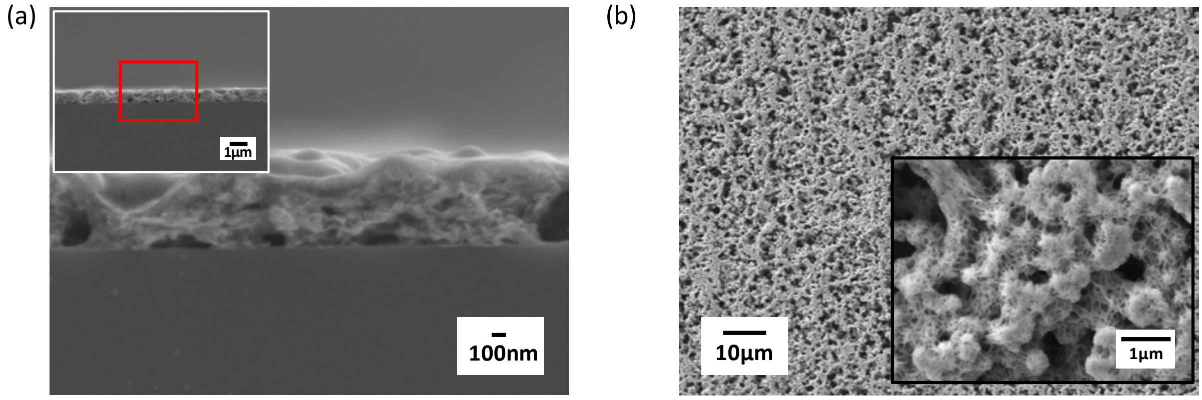

Figure S1. (a) Cross-sectional SEM images of the SnS_2-RGO/nafion film. (b) Top-view SEM images of the SnS_2-RGO.

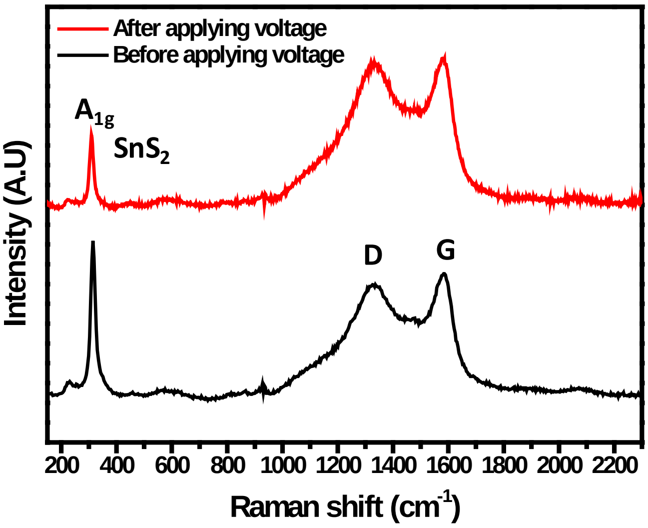

Figure S2. Raman spectra of the SnS_2-RGO sample before applying gate voltage (black) and after applying gate voltage (red).

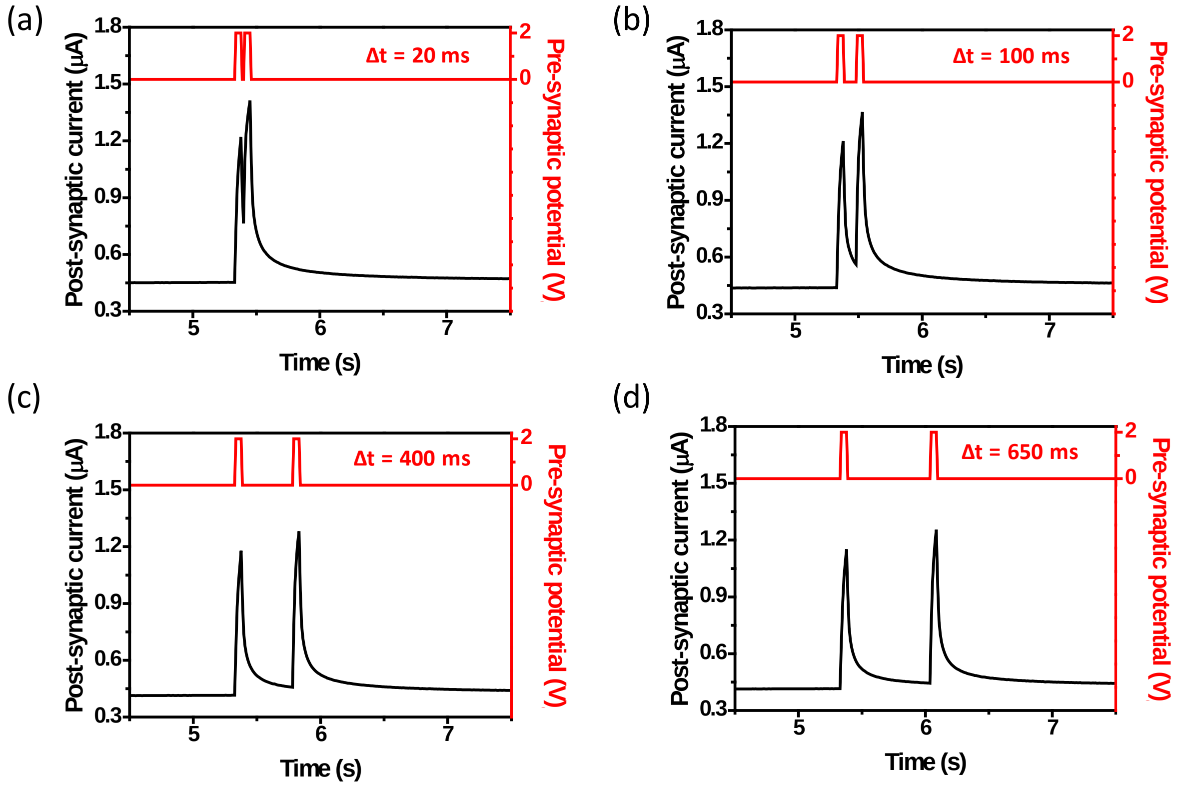

Figure S3. EPSC by a pair of consecutive voltage pulses (2 V, 50 ms) with pulse intervals of (a) 20 ms, (b) 100 ms, (c) 400 ms, and (d) 650 ms.

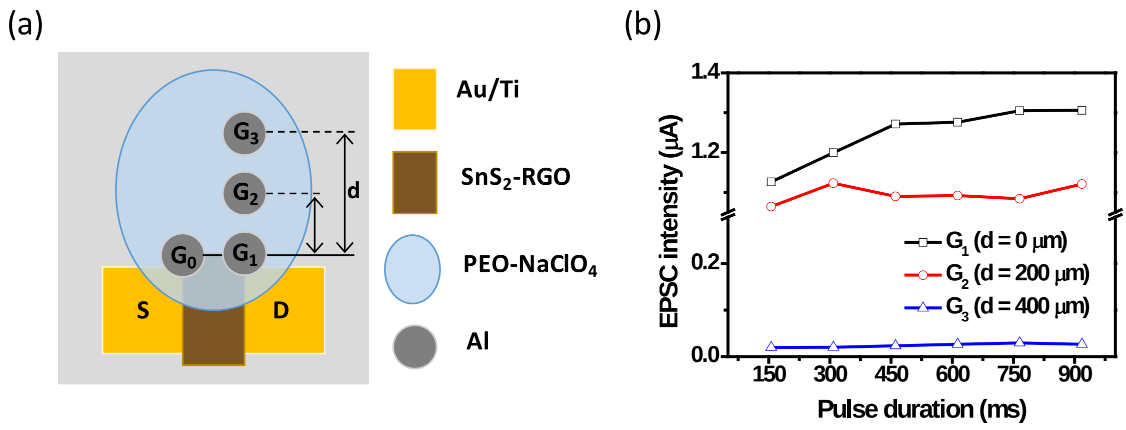

Figure S4. (a) Schematic image of artificial synapse with multi-gate synaptic inputs. (b) Spatiotemporal EPSC intensity with pulse duration at different channel-to-gate lateral distance *d*.

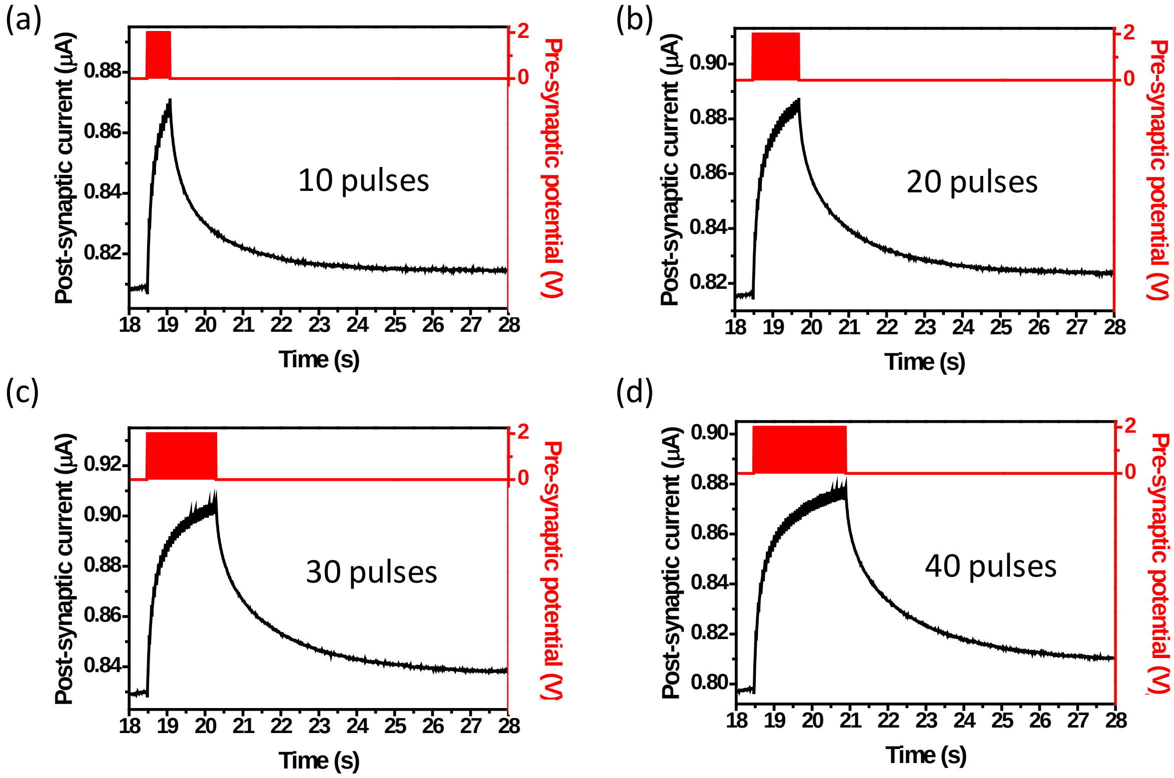

Figure S5. Transition from short-term to long-term memory with identical consecutive voltage pulses (2 V, 50 ms) and different pulse numbers of (a) *N*= 10, (b) *N*= 20, (c) *N*= 30, and (d) *N*= 40.

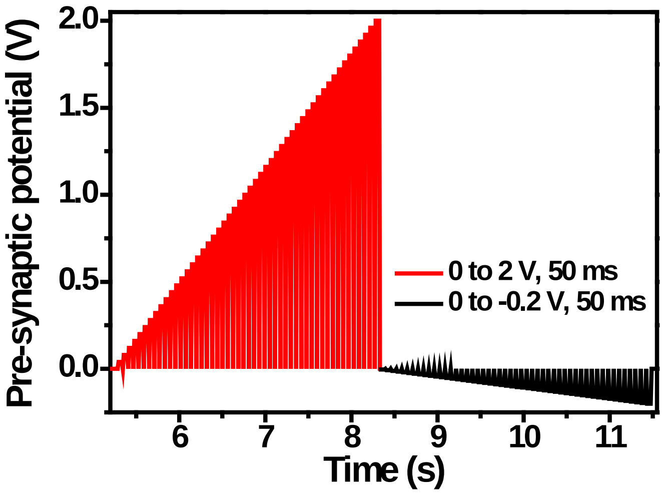

Figure S6. Pre-synaptic potential pulses. Positive voltage pulses were applied sequentially from 0 V to 2 V in 50 ms to measure the potentiation and negative voltage pulses were applied sequentially from 0 V to -0.2 V in 50 ms to measure the depression.

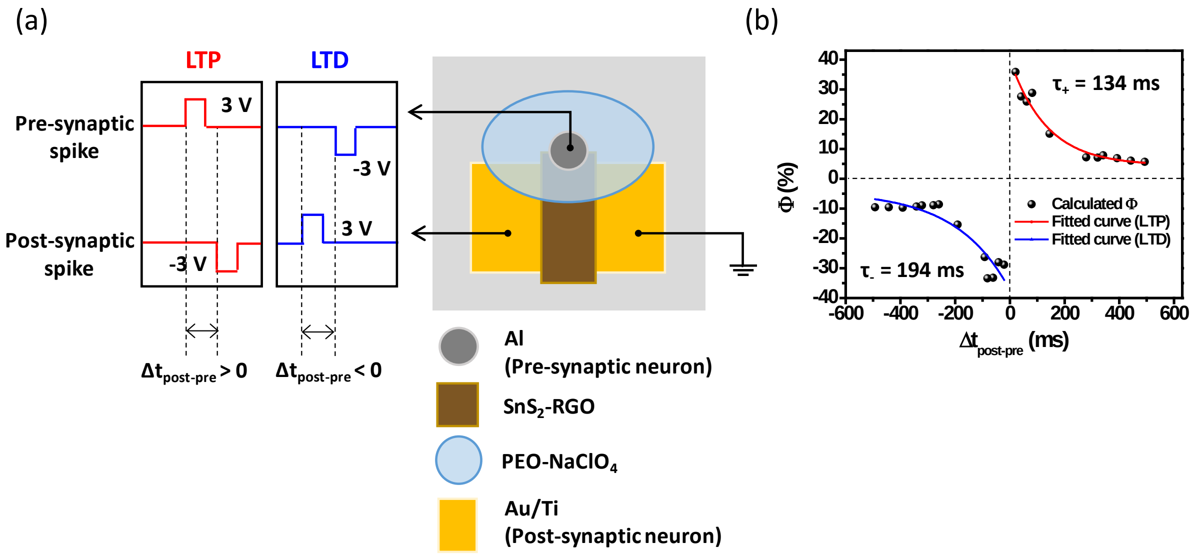

Figure S7. (a) Schematic image and pulse design for testing STDP behaviors. (b) Φ as a function of $\Delta t_{post\text{-}pre}$ ($\Phi = (W_{STDP} - W_0)/W_0$) and fitted curves of LTP/LTD with STDP functions, $\Phi\ (\Delta t_{post-pre} > 0) = A_{+} \cdot \exp(-\Delta t_{post-pre}/\tau_{+})$ and $\Phi\ (\Delta t_{post-pre} < 0) = A_{-} \cdot \exp(-\Delta t_{post-pre}/\tau_{-})$. The A_+ and A_ are amplitudes of LTP and LTD parts in the graph; the τ_+ and τ_- are time constants of LTP and LTD.[60,61]