

Electronic Synapse Device with Linearizing Conductance Using Quantized Conduction for Neuroinspired Computing

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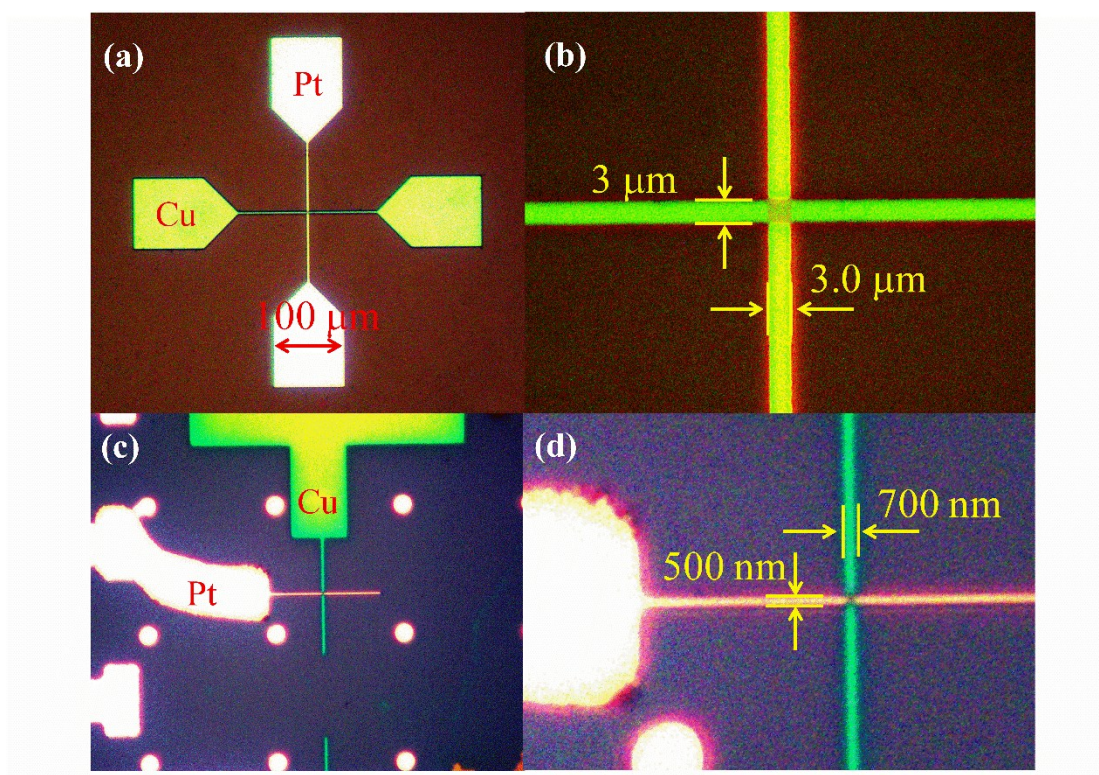


Figure S1. The photo of smaller device. a, b) $3\mu\text{m} \times 3\mu\text{m}$ devices by lithographic process and c, d) $500\text{nm} \times 700\text{nm}$ devices by electron beam lithography.

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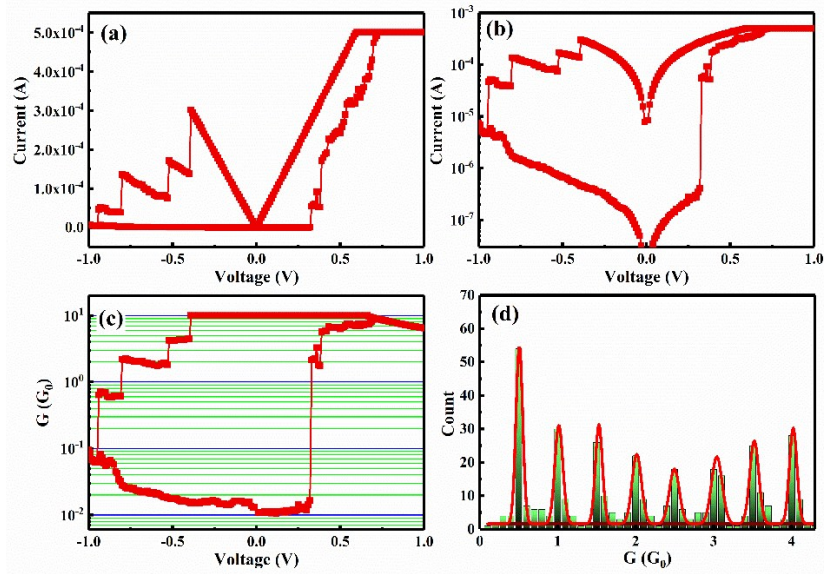


Figure S2. a) Typical DC I-V characteristics of Cu/Zr_{0.5}Hf_{0.5}O₂/Pt of 3 μm × 3 μm. b) I-V curve in the logarithmic scale. c) R-V curve in the logarithmic scale. d) Conductance-state changes histogram during 100 cycles, where peak positions were evident at integer and half-integer multiples of G₀. Red line corresponded to Gaussian fitting curve of the histogram.

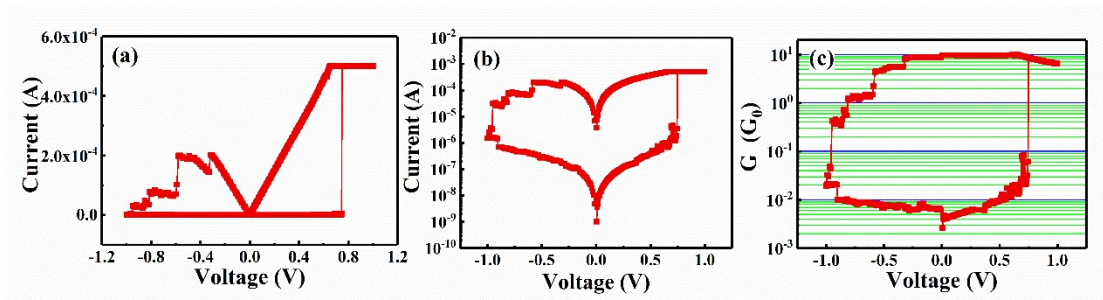


Figure S3. a) Typical DC I-V characteristics of Cu/Zr_{0.5}Hf_{0.5}O₂/Pt of 500 nm × 700 nm. b) I-V curve in the logarithmic scale. c) R-V curve in the logarithmic scale.

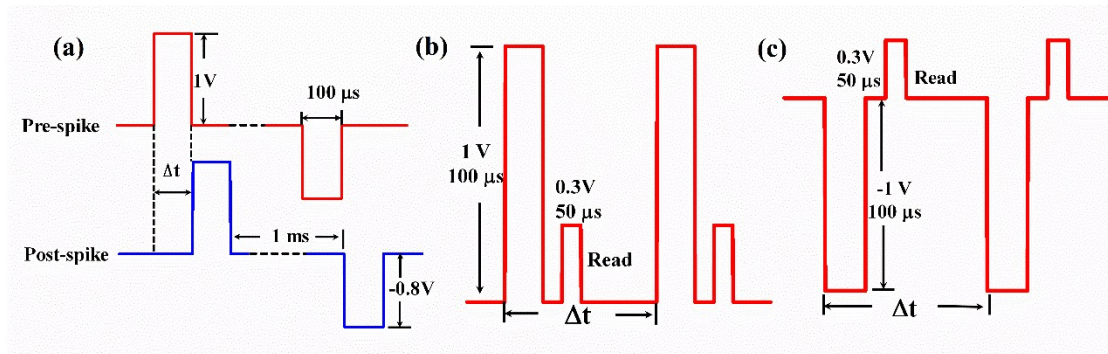


Figure S4. Pre- and postsynaptic spikes utilized to implement STDP and (PPF). (a) Spikes for asymmetric Hebbian learning rule. (b-c) Paired-pulse facilitation (PPF). (c) The positive waveform used for the PPF measurement. The negative waveform used for the PPF measurement.

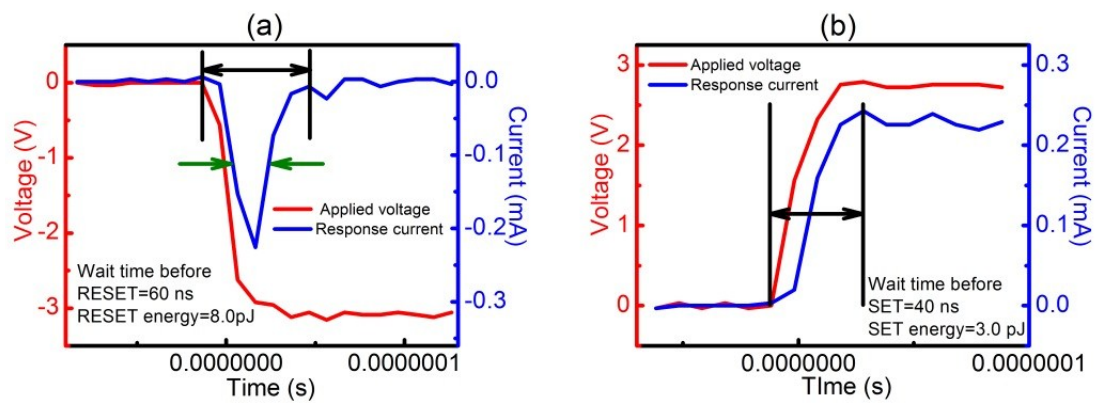


Figure S5. Applied voltage pulse and transient current response for a SET and RESET operation starting from the highest and lowest resistor states.