

## Supporting Information

### **Synaptic transistor with tunable synaptic behaviors based on thermo-denatured polar polymer material**

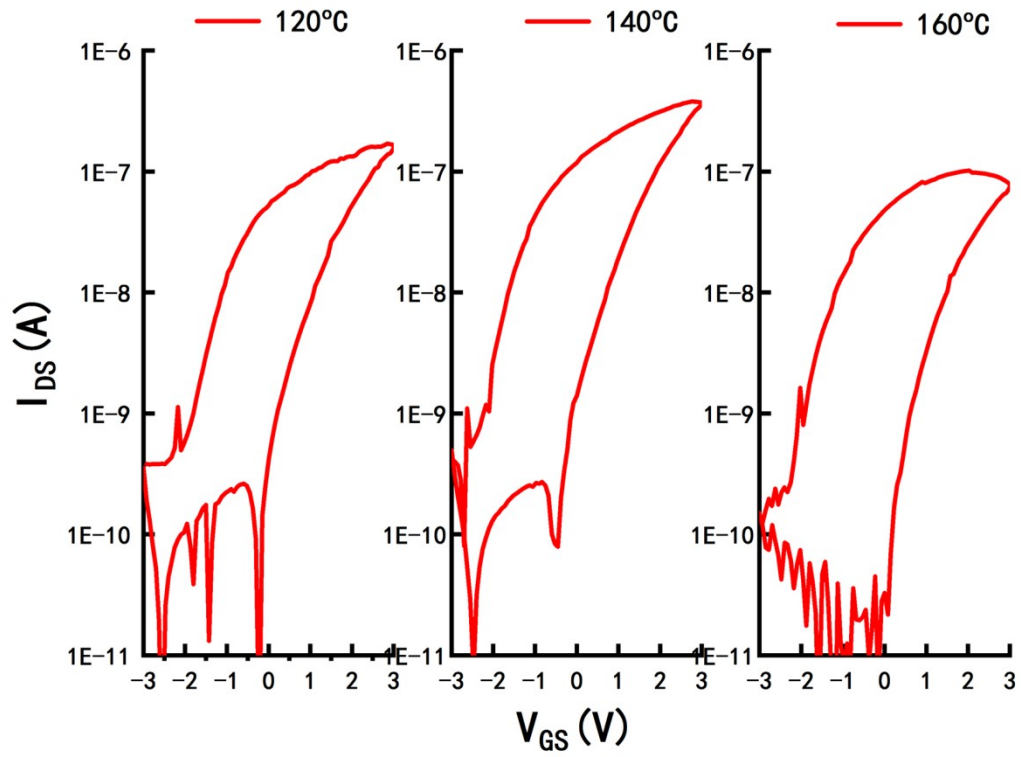
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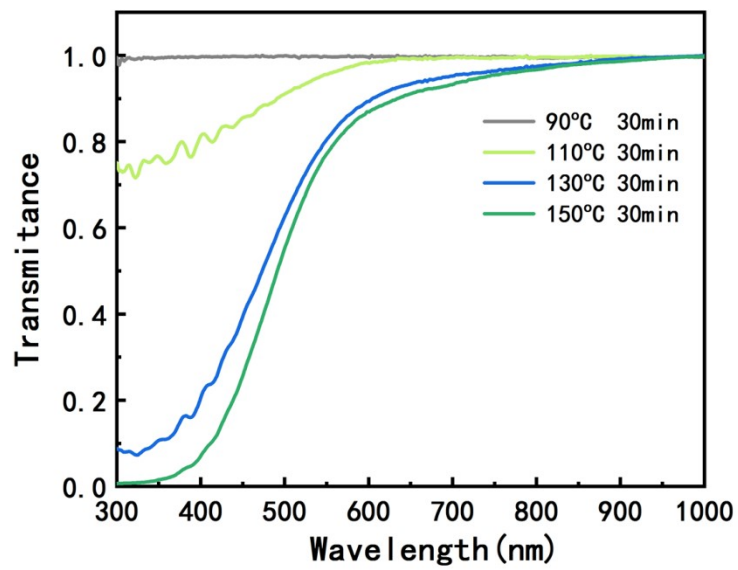
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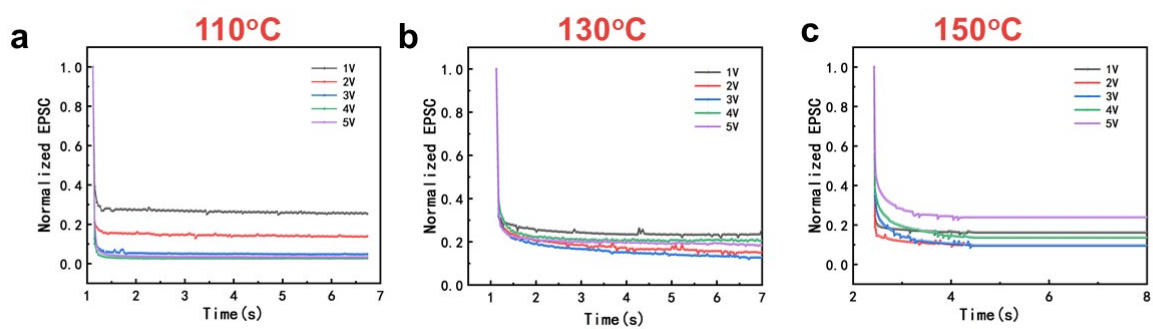
**Figure S1.** The dual sweep transfer curves of synaptic transistors under the same double-sweep voltage ( -3 V ~ 3 V) with annealing temperature of 120 °C, 140 °C and 160 °C.



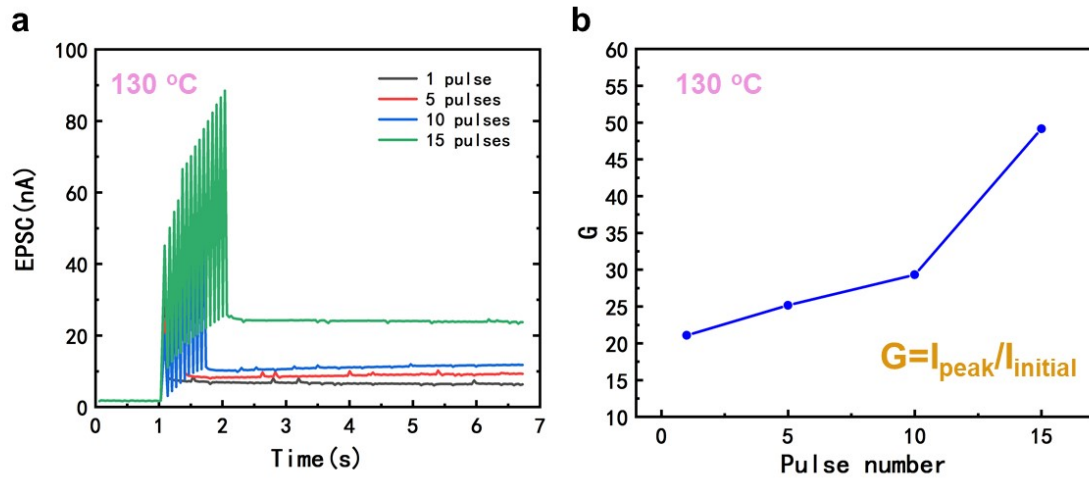
**Figure S2.** Photograph of the PAMPSA/PVA films coated on the quartz substrates according to the thermal treatment temperature (90–170 °C, 30 min).



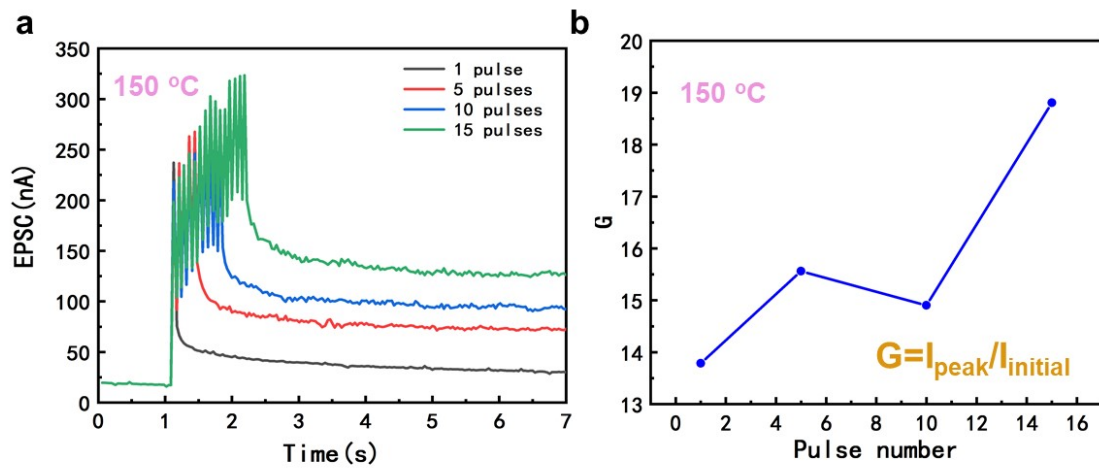
**Figure S3.** Optical transmittance curve of the PAMPSA/PVA films coated on the quartz substrates according to the thermal treatment temperature (90–170 °C for 30 min



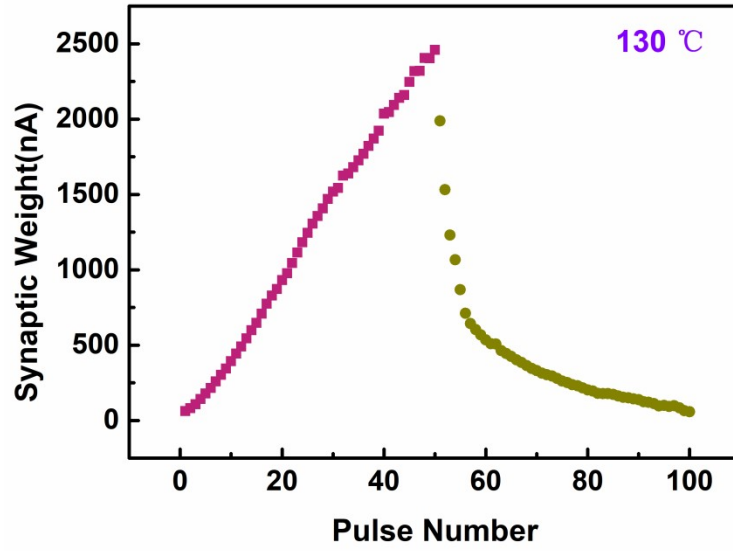
**Figure S4.** Normalized LTP responses of synaptic transistor under annealing temperature of a) 110 °C, b) 130 °C, c) 150 °C induced by presynaptic stimulation with a series of electrical pulses (1, 2, 3, 4, 5 V, 30 ms).



**Figure S5.** (a) LTP response of synaptic transistor stimulated by presynaptic spikes with pulse numbers ranging from 1 to 15 (amplitude 1 V, pulse width 30 ms and pulse interval 30 ms) at annealing temperature of 130 °C. (b) Summarize of  $G$  vs pulse numbers at 130 °C.  $G$  is defined as the ratio of  $I_{\text{peak}}$  after stimulation to  $I_{\text{initial}}$  before stimulation.

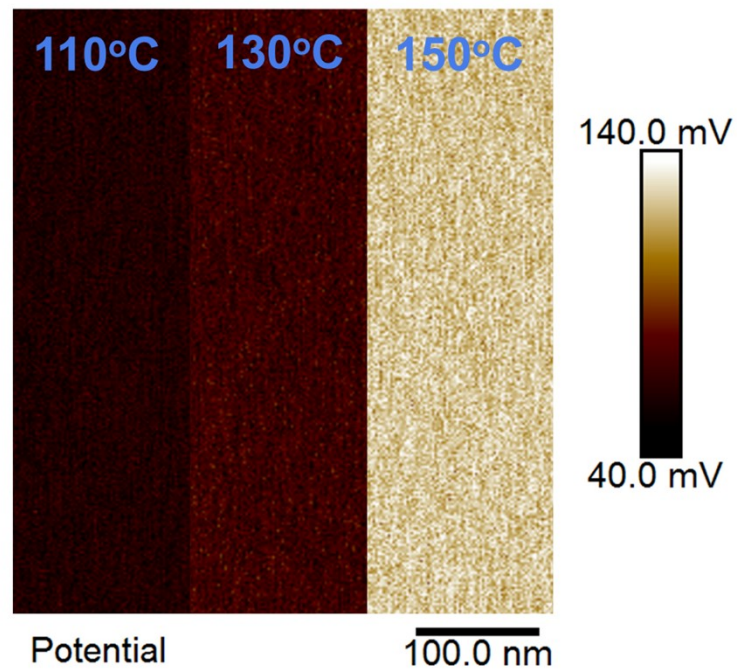


**Figure S6.** (a) LTP response of synaptic transistor stimulated by presynaptic spikes with pulse numbers ranging from 1 to 15 (amplitude 1 V, pulse width 30 ms and pulse interval 30 ms) at annealing temperature of 150 °C. (b) Summarize of G vs pulse numbers at 150 °C. G is defined as the ratio of  $I_{\text{peak}}$  after stimulation to  $I_{\text{initial}}$  before stimulation.

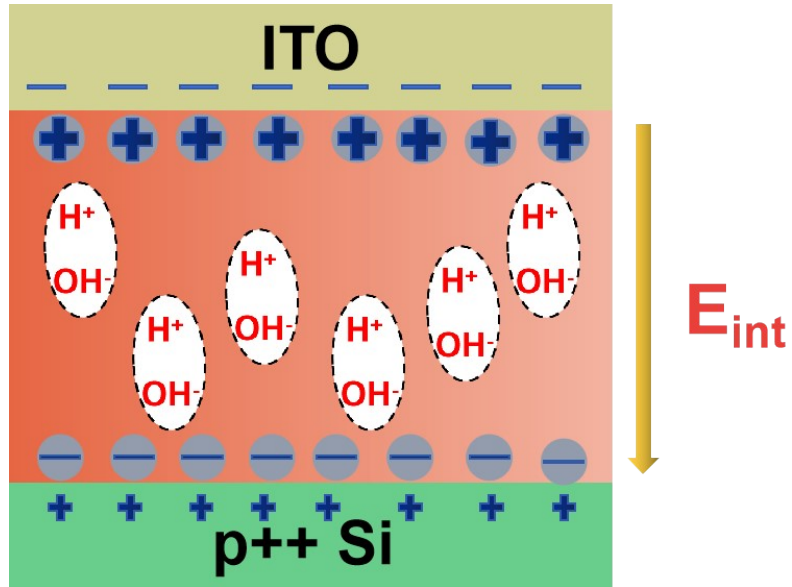


**Figure S7.** Synaptic weight after long-term potentiation and long-term depression behavior with 50 consecutive negative pulses (3 V for 60 ms, 30 ms interval) and 50 consecutive positive pulses (-3 V for 60 ms, 30 ms interval) at annealing temperature of 130 °C.





**Figure S8.** A comparison of surface potential images of PAMPSA/PVA film fabricated at annealing temperature of 110 °C, 130 °C, 150 °C using Kelvin Probe Force Microscopy (KPFM) .



**Figure S9.** Schematic diagram of the EDL mechanism of the PVA film in which the protons in the PVA insulation layer jumped between the hydroxyl group and the water molecule and subsequently producing a very large EDL capacitor.