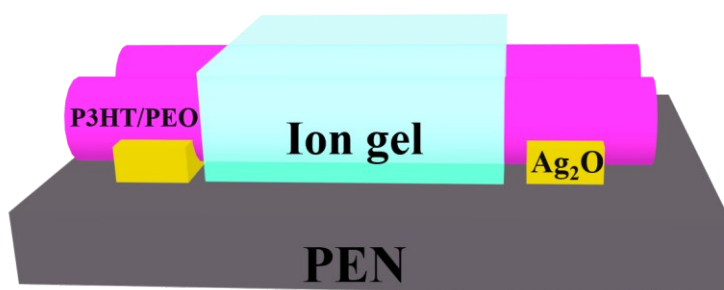
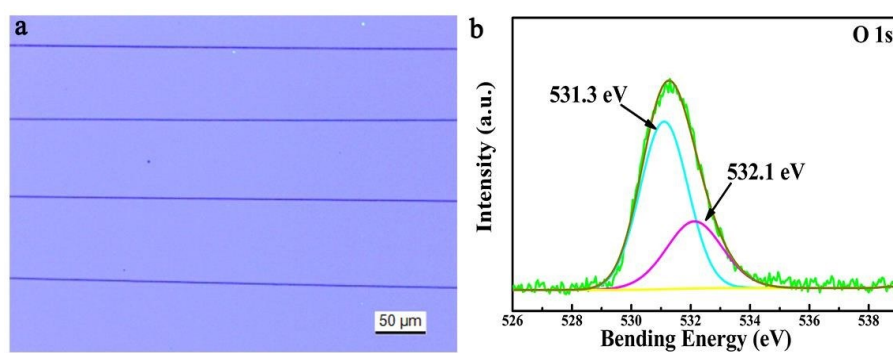


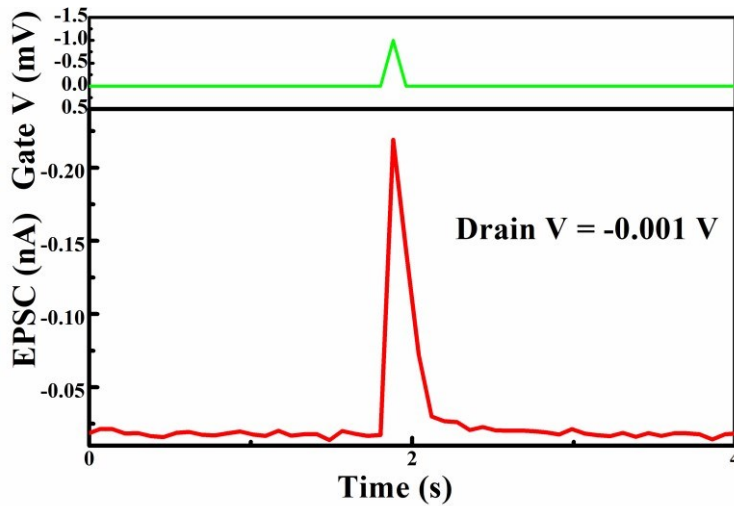
## Supporting Information



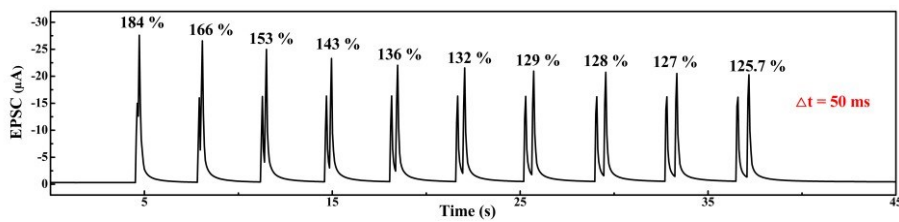
**Fig. S1.** Schematic diagram of Side view of APON-ST.



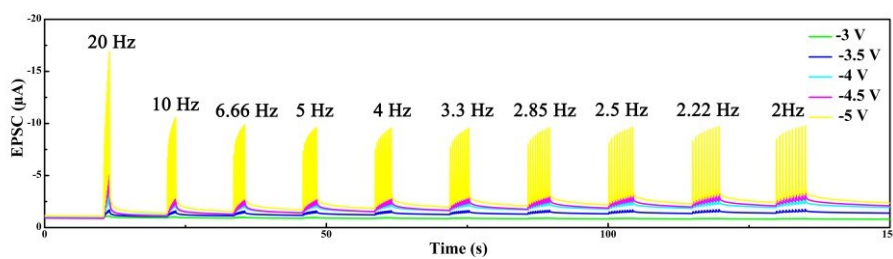
**Fig. S2.** (a) The OM of regularly arranged nanowires, (b) High-resolution O 1S XPS spectra for Ag<sub>2</sub>O electrode.



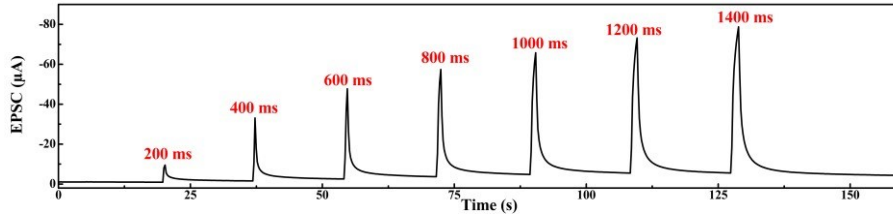
**Fig. S3.** EPSC triggered by a presynaptic spike (-0.001 V, 50 ms) under the drain voltage of -0.001 V.



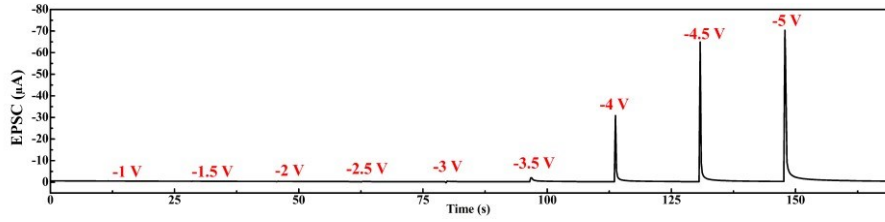
**Fig. S4.** Part of PPF of APON-ST with different interval ( $\Delta t = 50 \sim 600$  ms).



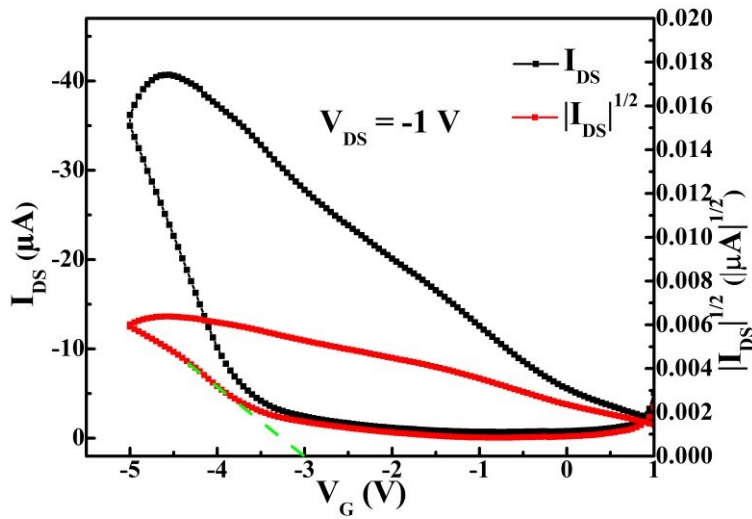
**Fig. S5.** Presynaptic spike rate-dependent (SRDP) behavior of APON-ST with different pulses voltage.



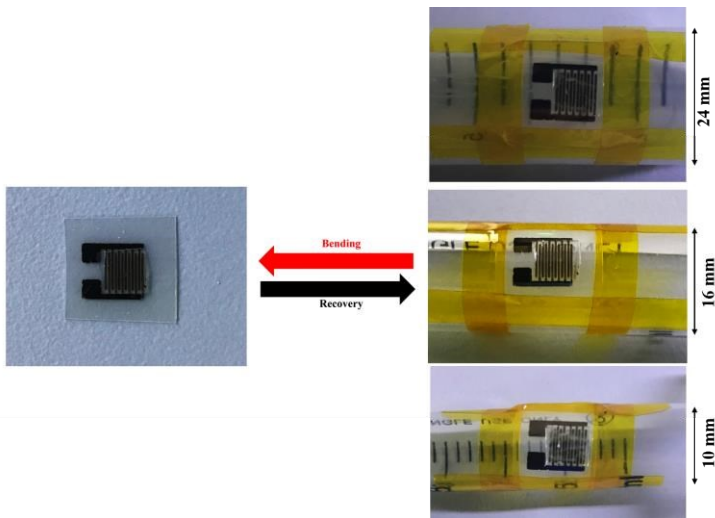
**Fig. S6.** Presynaptic spike duration-dependent (SDDP) behavior of APON-ST



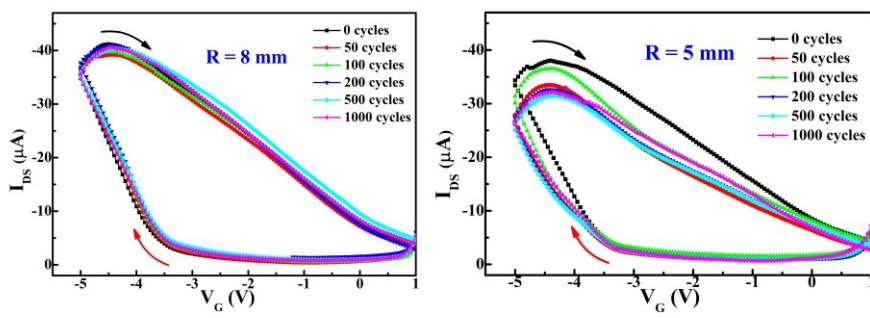
**Fig. S7.** Presynaptic spike voltage-dependent (SVDP) behavior of APON-ST.



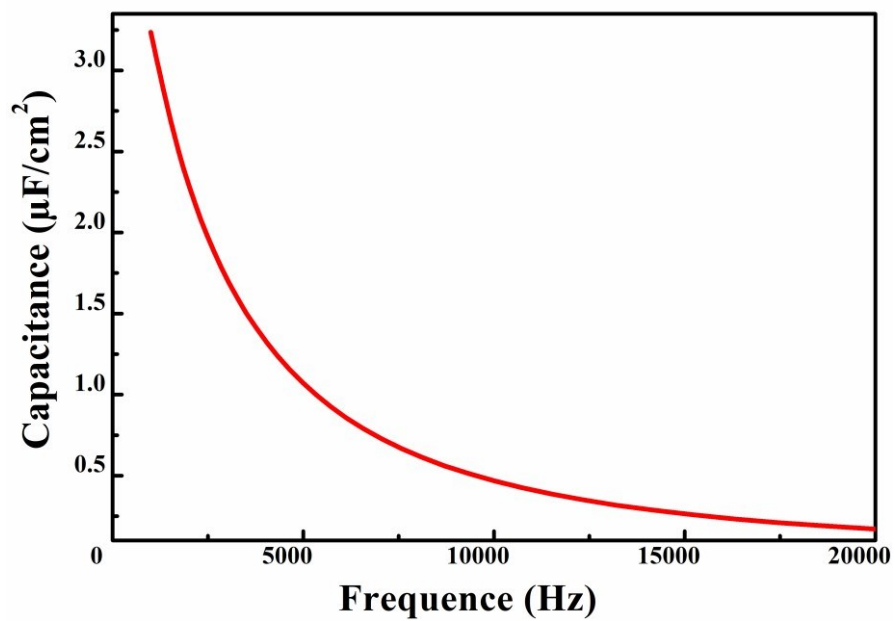
**Fig. S8.** A transfer curve of APON-ST measured by voltage sweep on the gate ( $V_G$ ) at a bias voltage of  $V_{DS} = -1$  V.



**Fig. S9.** Bending process diagram of APON-ST.



**Fig. S10.** Bending process diagram of APON-ST.



**Fig. S11.** The capacitance as a function of frequency of ion gels.