Supporting Information

Self-powered optoelectronic artificial synapse based on a lead-free perovskite film for artificial visual perception system

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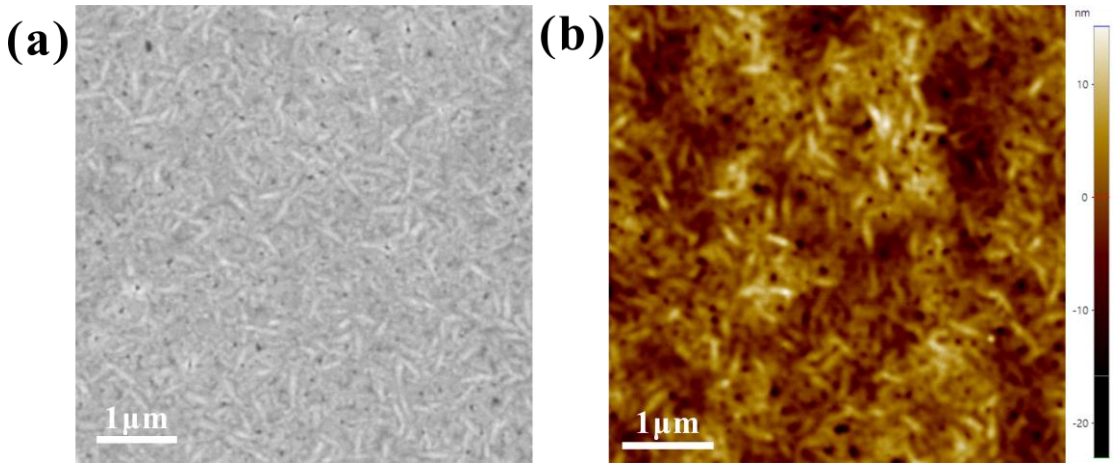

Figure S1. SEM and AFM spectrums of the PMMA film deposited on $Cs_3Bi_2Br_9$ film.

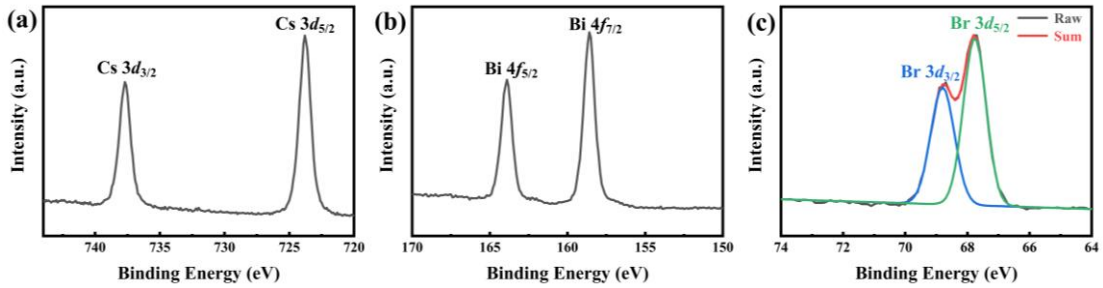

Figure S2. XPS spectrum of the $Cs_3Bi_2Br_9$ film. (a) Cs; (b) Bi and (c) Br elements.

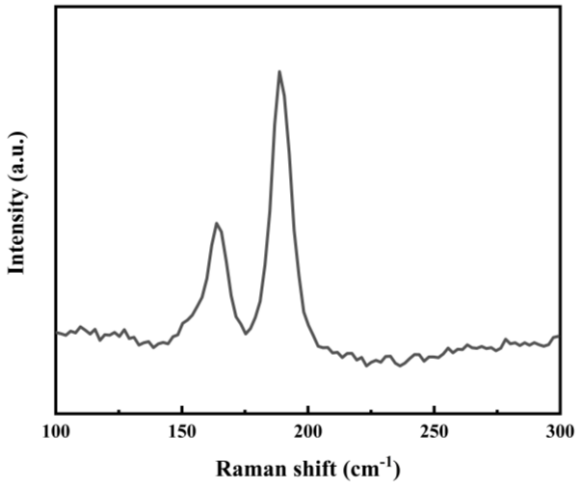

Figure S3. Raman spectra of $Cs_3Bi_2Br_9$ film.

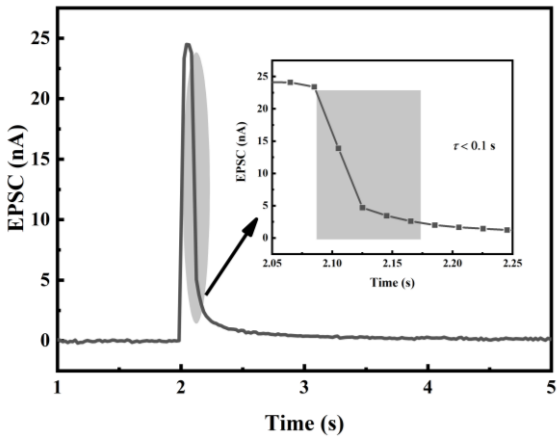

Figure S4. EPSC stimulated by an optical spike for a device without PMMA layer under a bias of 0 V. The wavelength, duration and power density of the optical spike are 445 nm, 100 ms and 35.5 mW cm^{-2}, respectively.

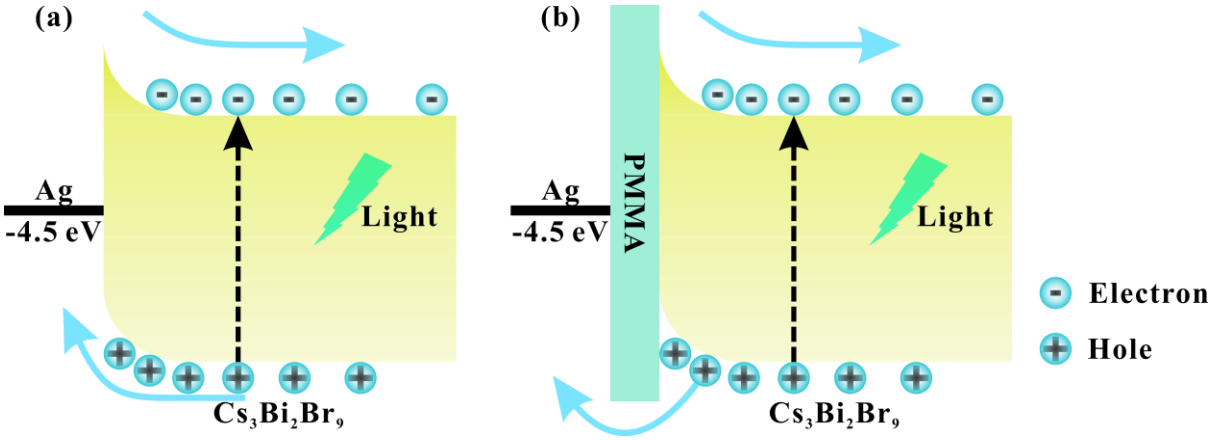

Figure S5. The band diagram of the (a) ITO/$Cs_3Bi_2Br_9$/Ag and ITO/$Cs_3Bi_2Br_9$/PMMA/Ag devices under optical stimulus.

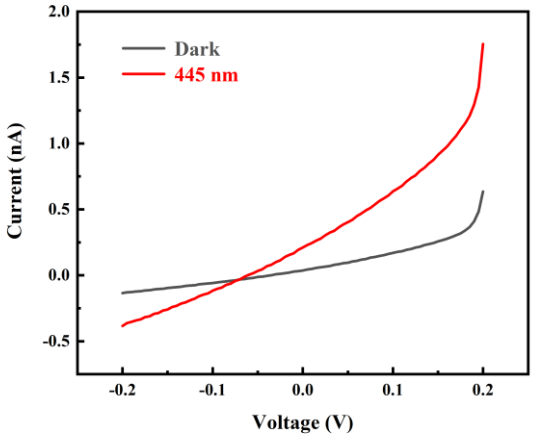

Figure S6. The I-V curves of the ITO/$Cs_3Bi_2Br_9$/PMMA/Ag device.

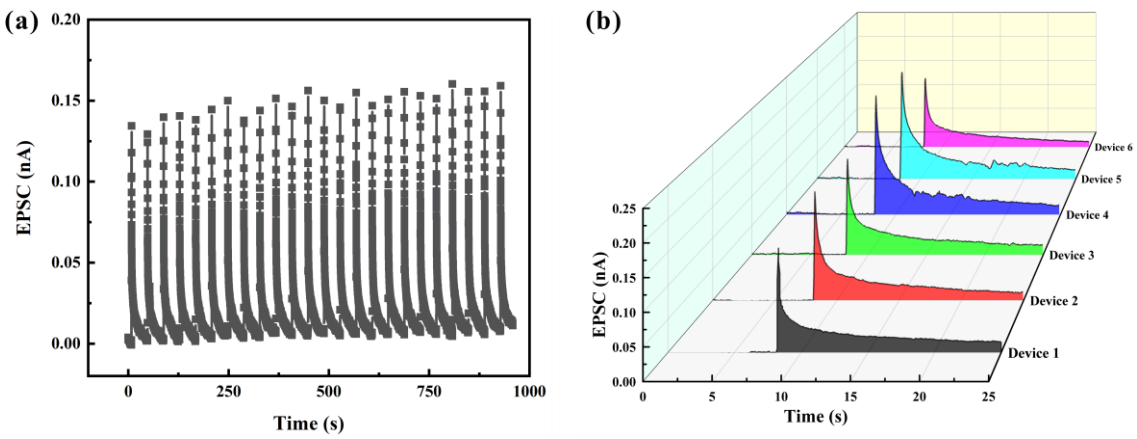

Figure S7. (a) EPSC signal after an optical spike are repeatedly stimuli same device 24 times. The interval between the two optical stimuli was 40 s. (b) EPSC stimulated by an optical spike for 6 devices. The wavelength, duration and power density of the optical spike are 445 nm, 100 ms and 35.5 mW cm^{-2}, respectively.

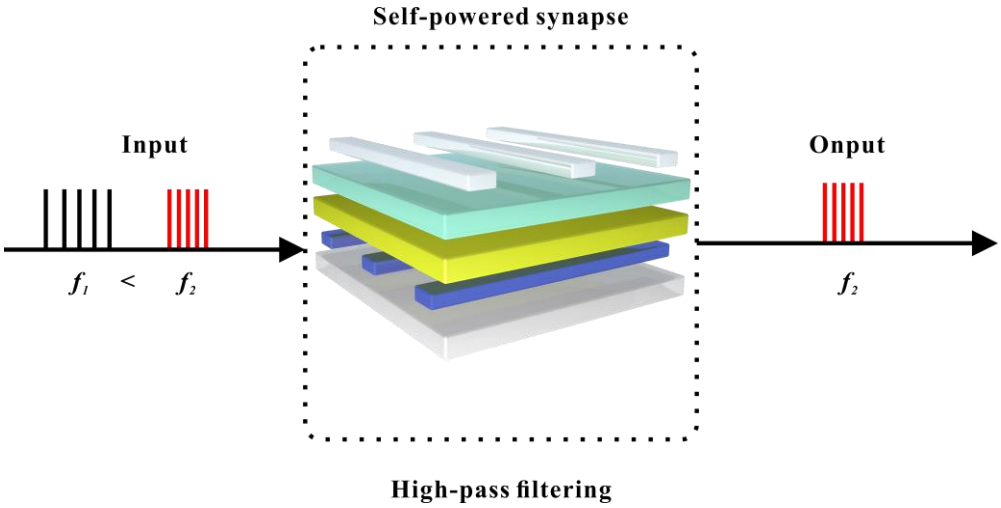

Figure S8. Schematic diagram of high-pass filtering function.

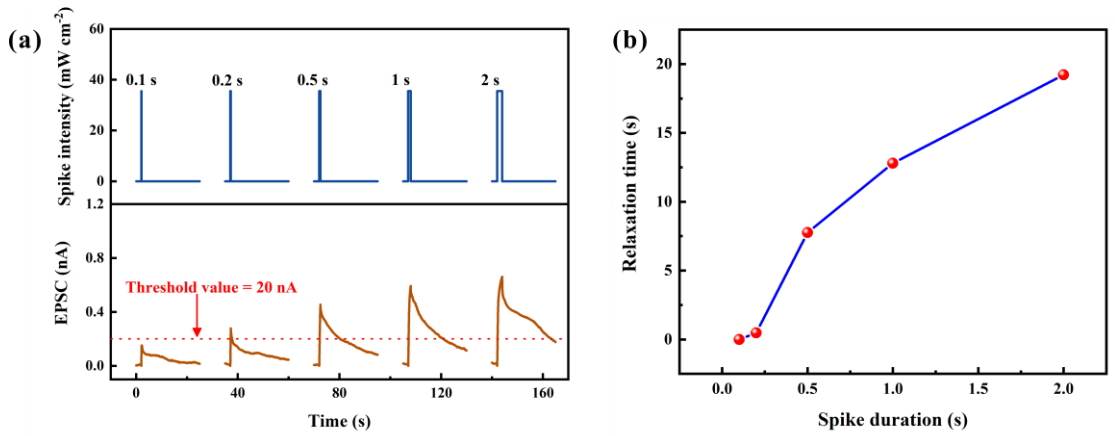

Figure S9. (a) Optical spikes with intensity of 35.5 mW cm^{-2} and various duration from 0.1 to 2 s were used to present the spike-duration-dependent threshold and relaxation characteristics. (b) The relaxation time of triggered EPSCs to threshold value (0.2 nA) by the various spike duration plotted as a function.

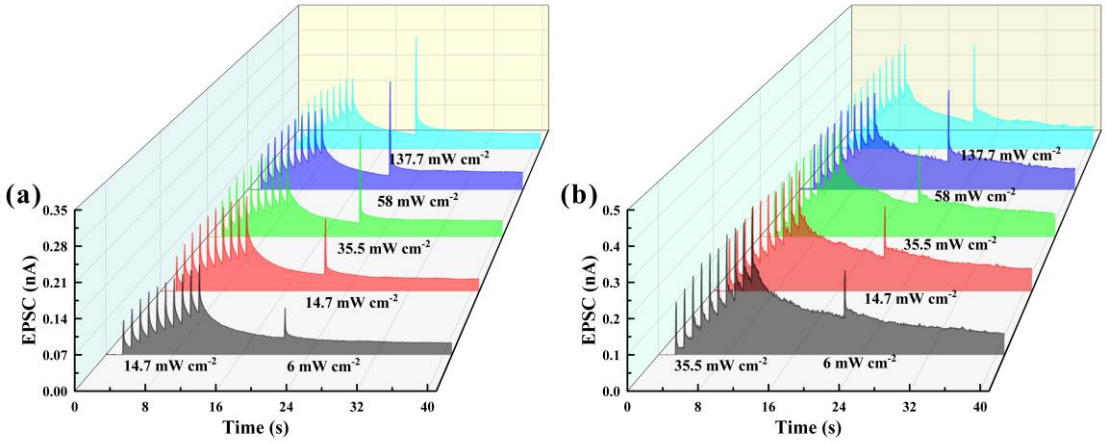

Figure S10. Trains of 10 optical spikes with intensity of (a) 14.7 mW cm^{-2} and (b) 35.5 mW cm^{-2} are applied to the self-powered device as the wounded condition before a single optical spike with various intensity from 6 to 137.7 mW cm^{-2}.