Supplementary Materials

NIR-Triggered Logic Gate in MXene-Modified Perovskite Resistive Random Access Memory

Rongbin Li,[a‡] Yan Sun,[a‡] Qianyu Zhao,[a] Xin Hao,[a] Haowei Liang,[a] Shengang Xu,[a,b] Yingliang Liu,*[ab] Xiaoman Bi,*[ab] Shaokui Cao,[ab]

[a]School of Materials Science and Engineering, Zhengzhou University, Zhengzhou 450001, People's Republic of China

[b]Henan Key Laboratory of Advanced Nylon Materials and Application, Zhengzhou university, Zhengzhou 450001, People's Republic of China

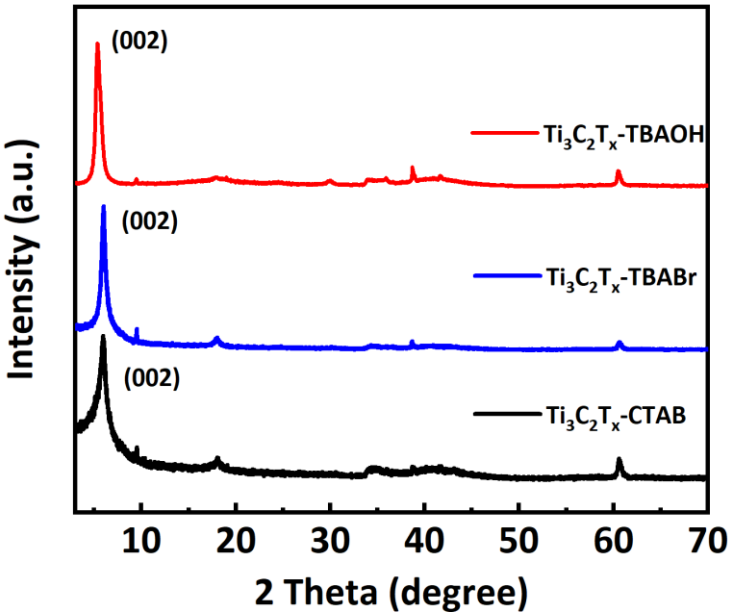

Fig. S1 XRD patterns of $Ti_3C_2T_x$-TBAOH, $Ti_3C_2T_x$-TBABr, $Ti_3C_2T_x$-CTAB.

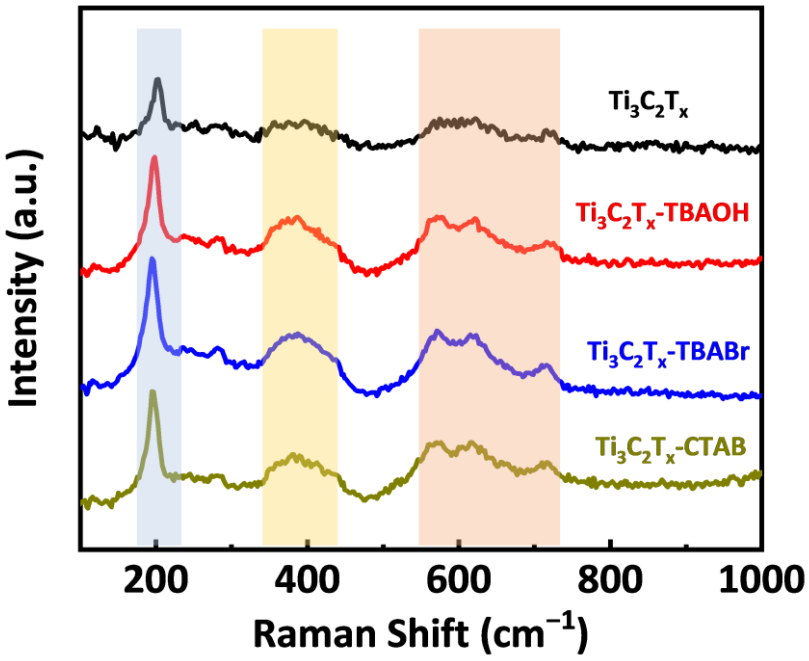

Fig. S2 Raman spectra of $Ti_3C_2T_x$, $Ti_3C_2T_x$-TBAOH, $Ti_3C_2T_x$-TBABr and $Ti_3C_2T_x$-CTAB.

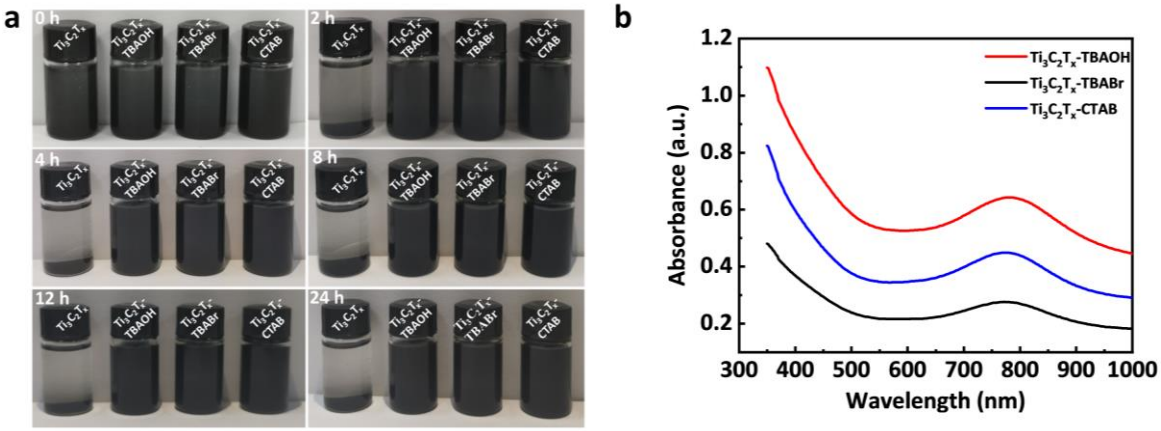

Fig. S3 (a) Dispersibility of $Ti_3C_2T_x$-TBAOH, $Ti_3C_2T_x$-TBABr, $Ti_3C_2T_x$-CTAB in DMF; (b) The UV-vis-NIR absorption spectra after standing for 24 h.

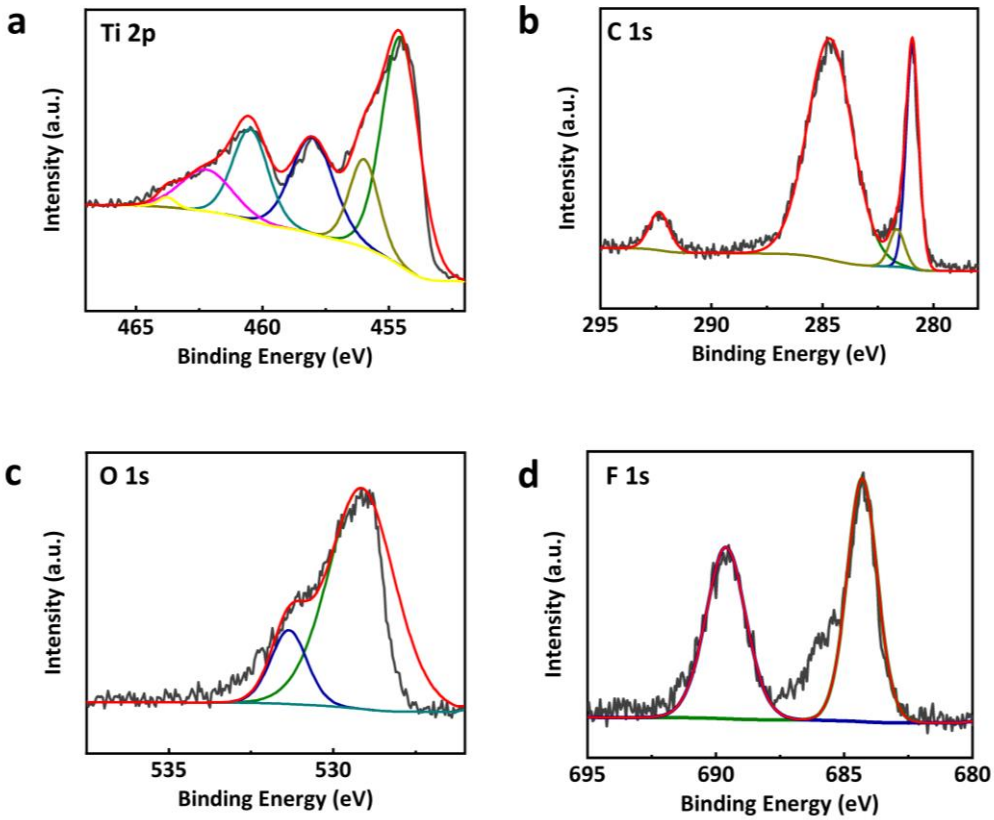

Fig. S4 High-resolved XPS spectra of Ti2p, C1s, O1s and F1s.

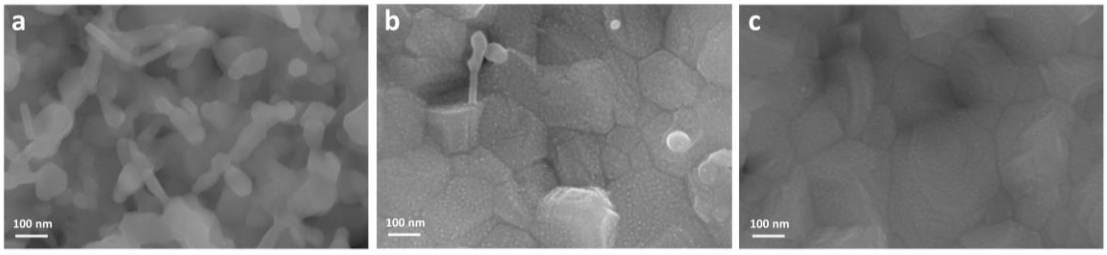

Fig. S5 Magnified SEM images of $Ti_3C_2T_x$ -TBAOH-modified perovskite film (a, 0wt%; b, 0.05wt%; c, 0.1wt%).

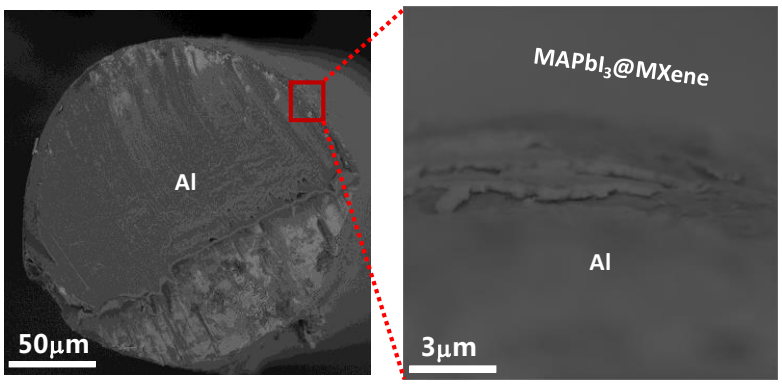

Fig. S6 Cross-sectional SEM images of $Ti_3C_2T_x$ -TBAOH-modified perovskite film.

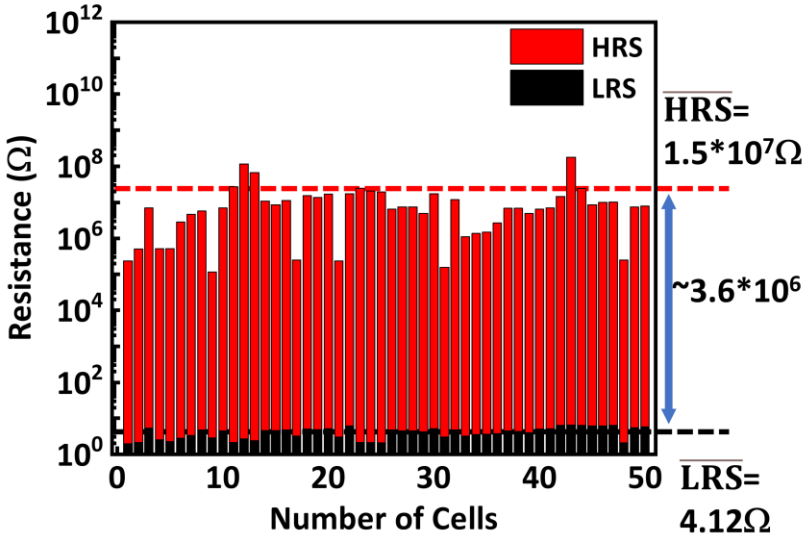

Fig. S7 HRS/LRS resistance for 50 pristine devices without the $Ti_3C_2T_x$-TBAOH additive.

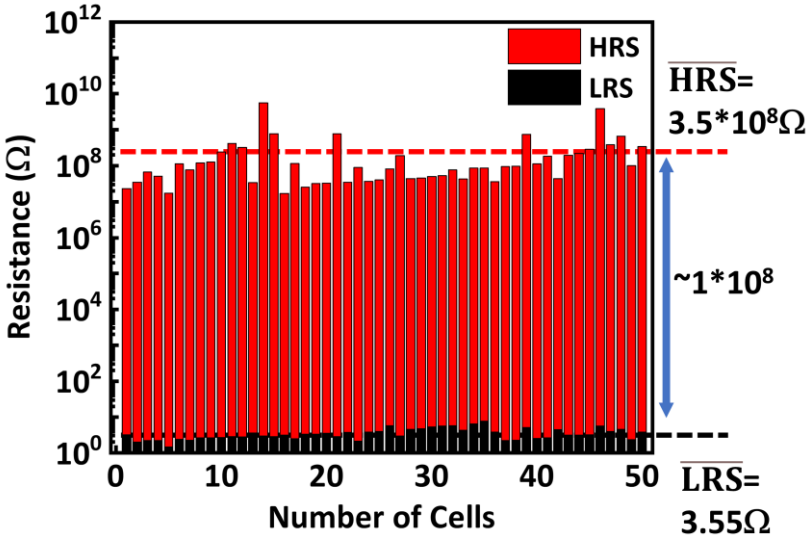

Fig. S8 HRS/LRS resistance for 50 $Ti_3C_2T_x$-TBAOH-modified devices (0.1 wt%).

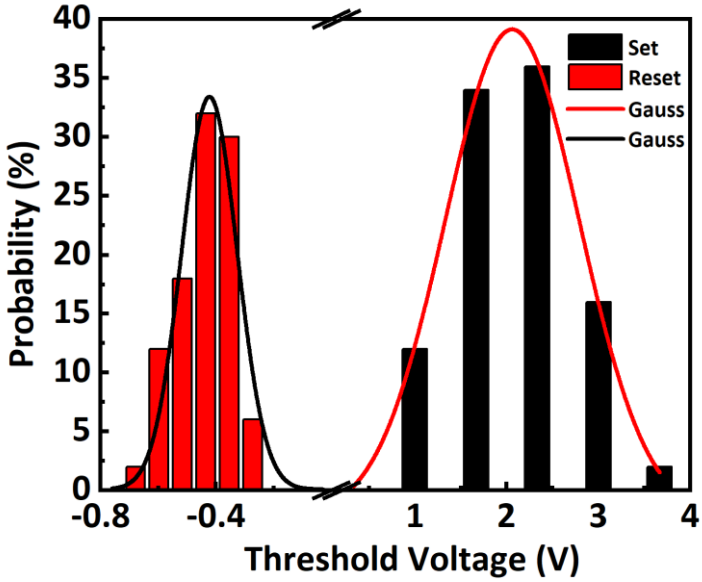

Fig. S9 Histogram of SET/RESET voltage of pristine devices without the $Ti_3C_2T_x$ -TBAOH additive.

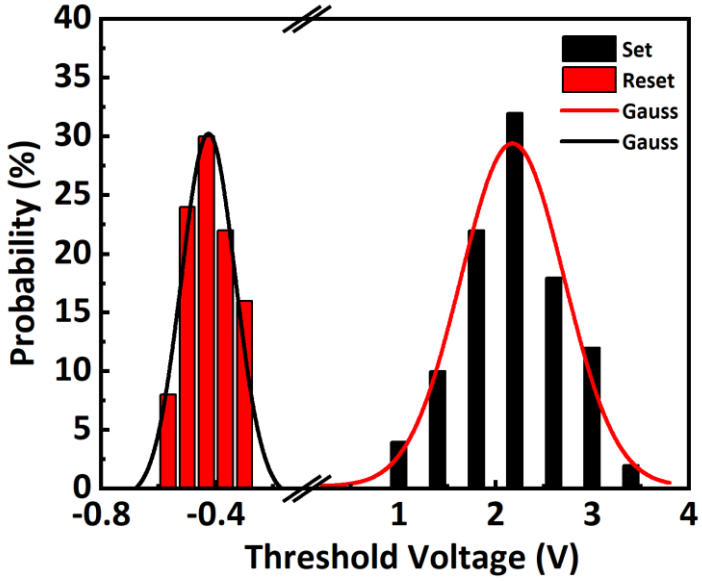

Fig. S10 Histogram of SET/RESET voltage of $Ti_3C_2T_x$-TBAOH-modified devices (0.1 wt%).

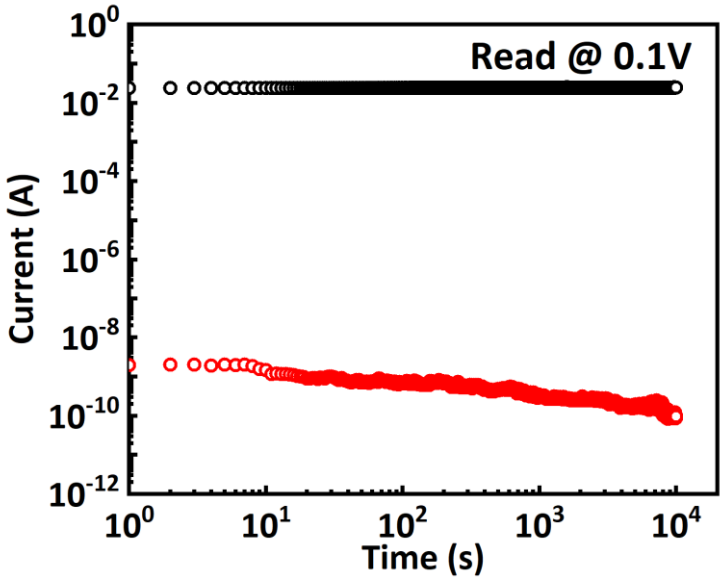

Fig. S11 Retention characteristics of pristine devices without the $Ti_3C_2T_x$ -TBAOH additive.

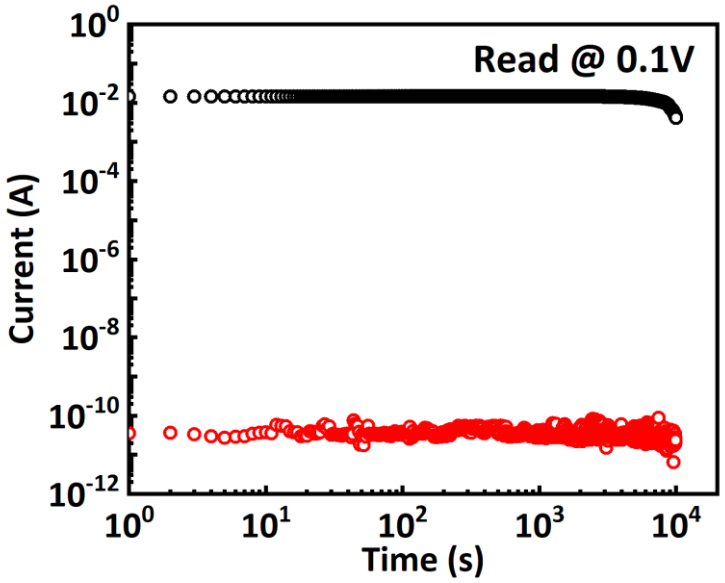

Fig. S12 Retention characteristics of $Ti_3C_2T_x$-TBAOH-modified devices (0.1 wt%).

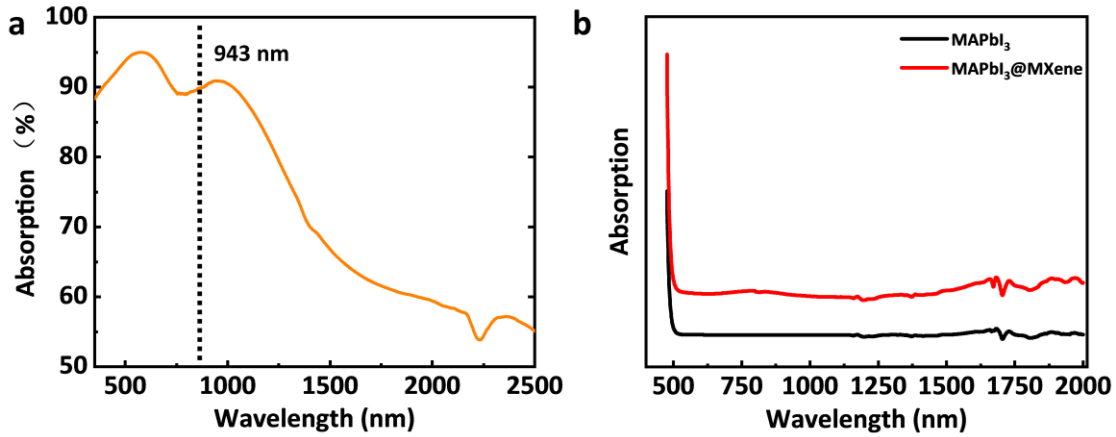

Fig. S13 UV-vis-NIR spectra of $Ti_3C_2T_x$-TBA powders (a) and $MAPbI_3$@MXene solution (DMF: DMSO= 4: 1, b).

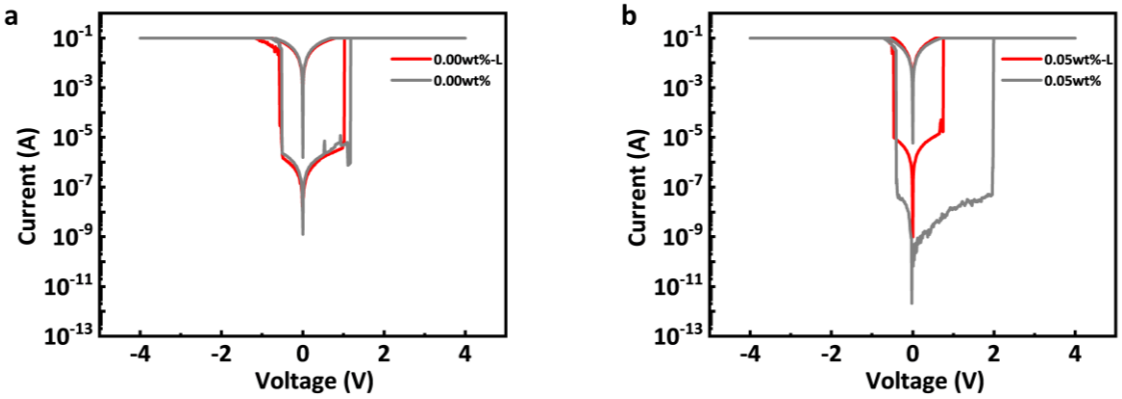

Fig. S14 I–V curves for pristine (a) and 0.1 wt% $Ti_3C_2T_x$-TBAOH-modified (b) devices in dark and under light irradiation.

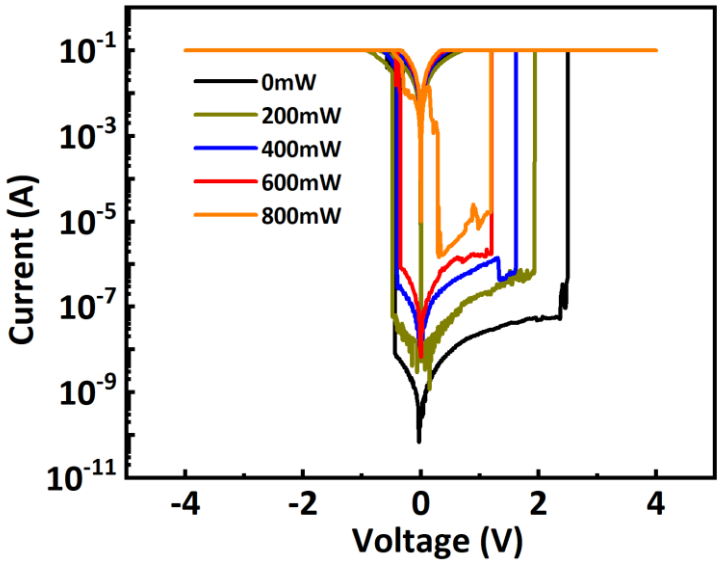

Fig. S15 I-V curves of 0.1 wt% $Ti_3C_2T_x$-TBAOH-modified RRAM device under illumination with different laser power.

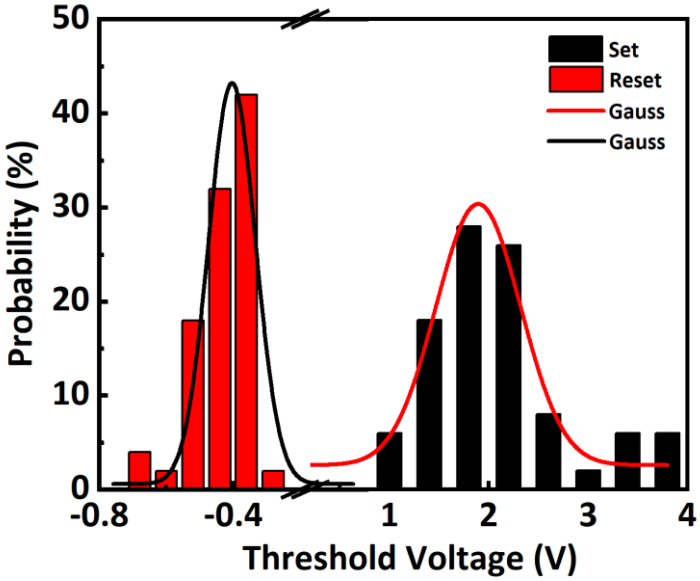

Fig. S16 Histogram of SET/RESET voltage of pristine devices under the NIR illumination.

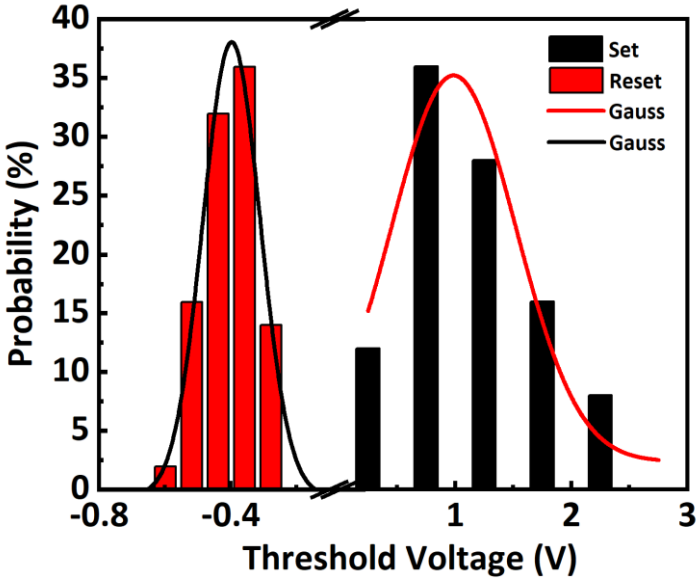

Fig. S17 Histogram of SET/RESET voltage of 0.1wt% $Ti_3C_2T_x$-TBAOH-modified devices under the NIR illumination.

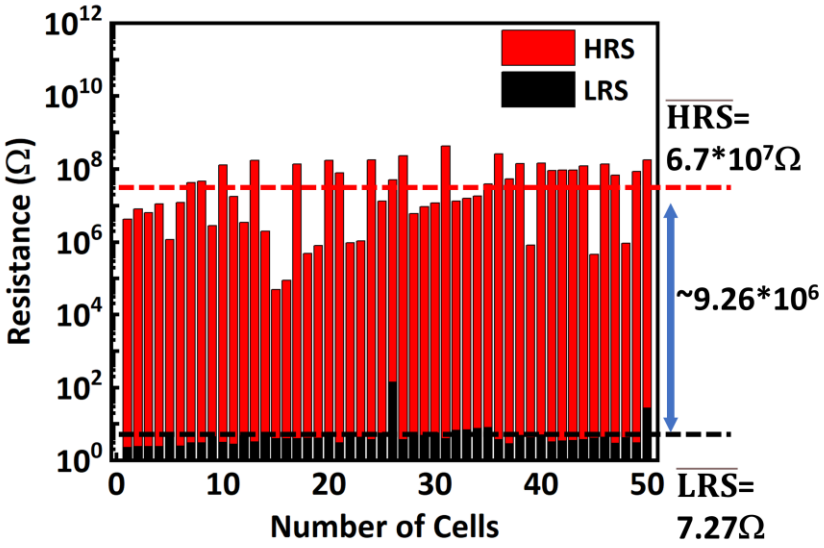

Fig. S18 HRS/LRS resistance for 50 pristine devices under the NIR illumination.

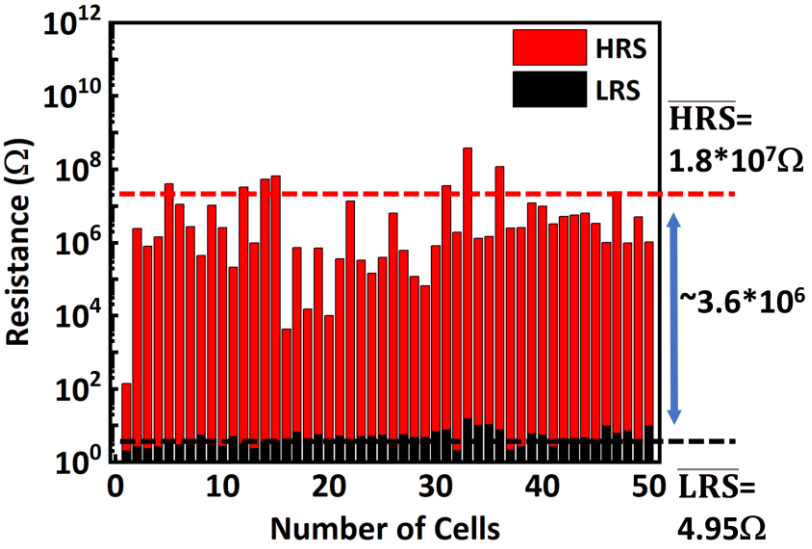

Fig. S19 HRS/LRS resistance for 50 $Ti_3C_2T_x$-TBAOH-modified devices (0.1wt%) under the NIR illumination.

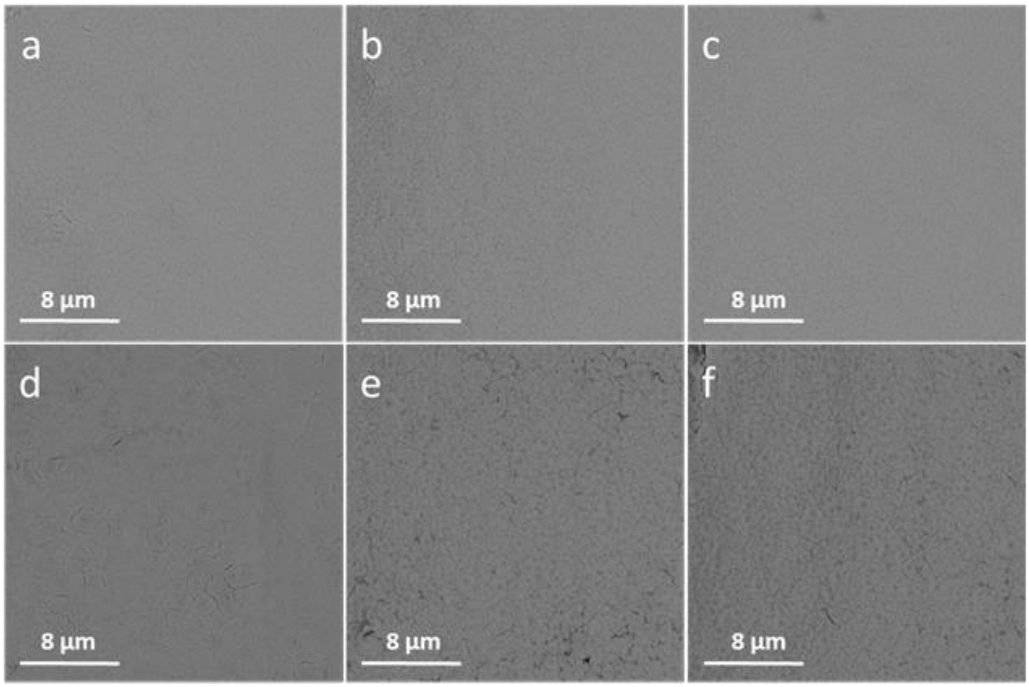

Fig. S20 SEM images of $Ti_3C_2T_x$ -TBAOH-modified perovskite film (a-c, before illumination; d-f, after illumination).