Supporting Information

Solution-processed and self-powered photodetector in vertical architecture using mixed-halide perovskite for highly sensitive UVC detection

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Calculation of the trap density

The trap densities of the electron/hole-only device were calculated using the following equation:

$$n_{traps} = \frac{2\varepsilon_0\varepsilon}{q\,V_{TFL}L^2}$$

where ε_0 is the vacuum permittivity ($\varepsilon_0 = 8.8542 \times 10^{-12}$), ε is the dielectric constant of perovskite (ε =25), q is, q is the elementary charge (q= 1.6022×10^{-19} C), L is the thickness of perovskite (L= 580 nm) and V_{TFL} is the trap-filled limit voltages of the electron/hole-only device which determined by I-V curve in dark condition. V_{TFL} of the hole-only device and electron-only device were 0.195 V and 0.45 V, respectively. According to the above values, the hole and trap densities (n_{traps}) of devices were estimated equal to 1.6×10^{15} cm^{-3} and 3.6×10^{15} cm^{-3}.

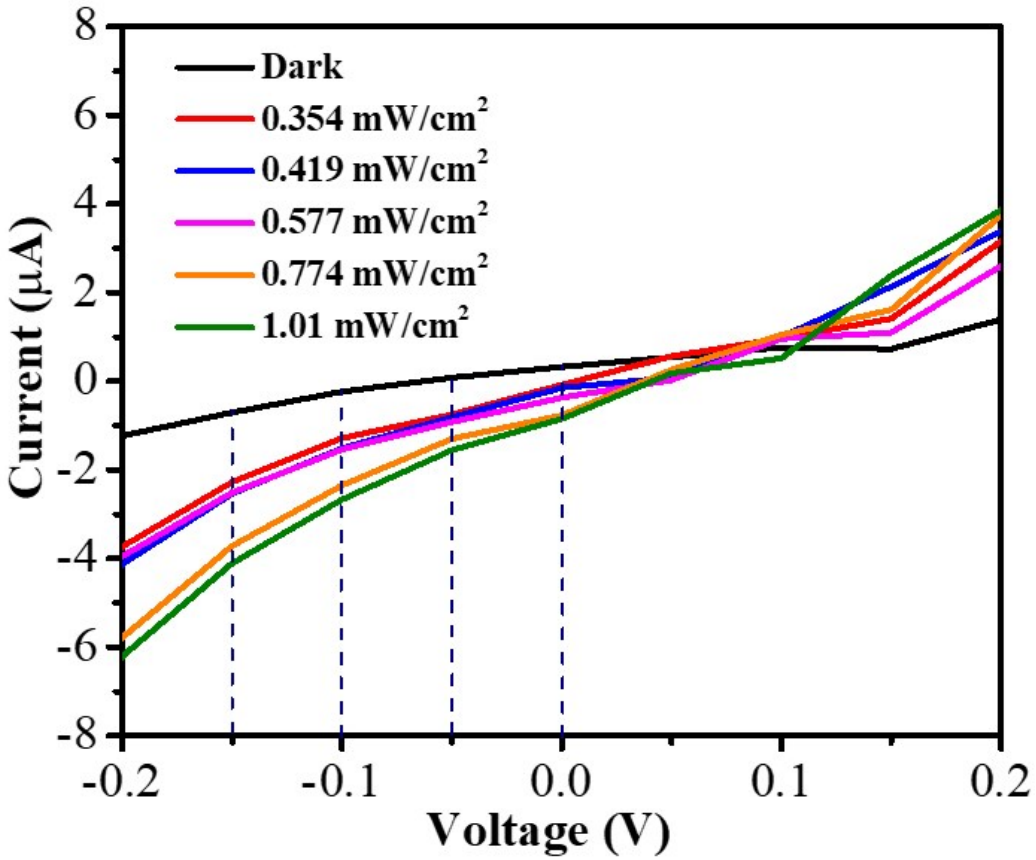

Fig. S1 *I-V* characteristics of the photodetector measured under dark and different light intensities at 254 nm light and 0 V bias voltage.

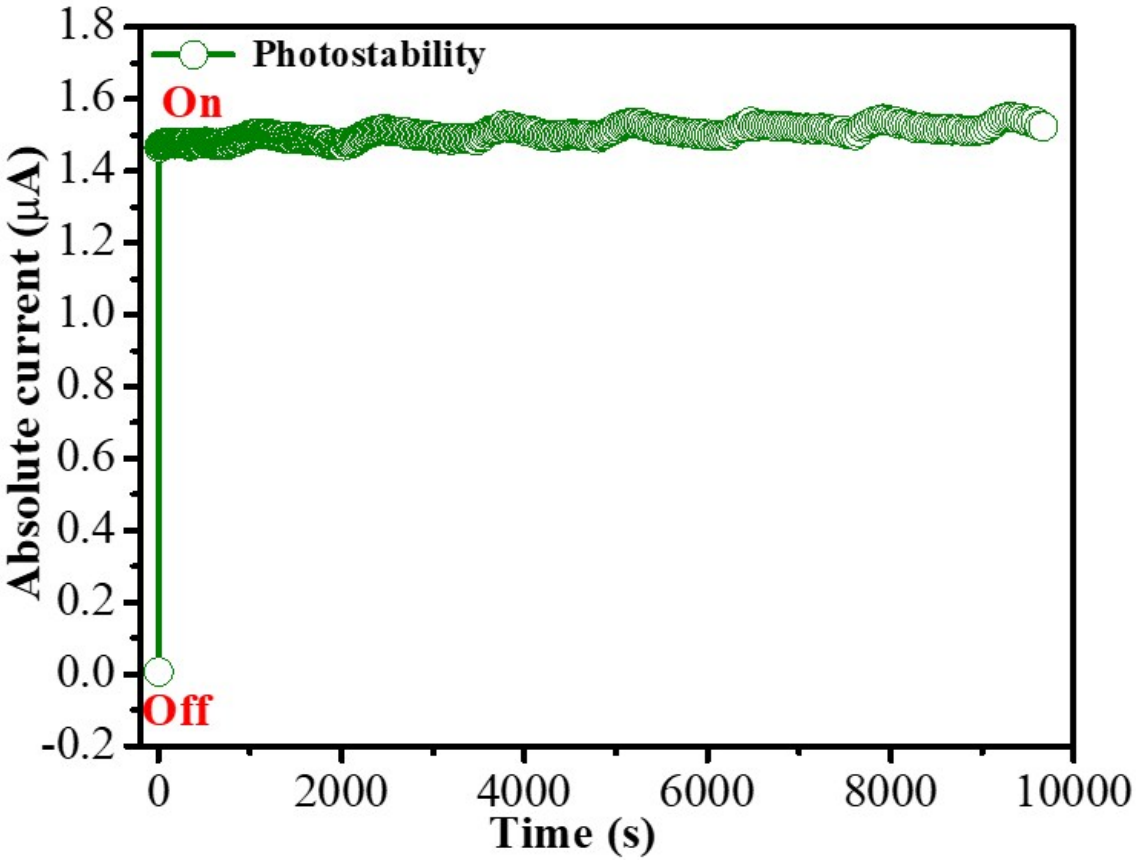

Fig. S2 The photostability of photodetector measured under 254nm-UVC light illumination.

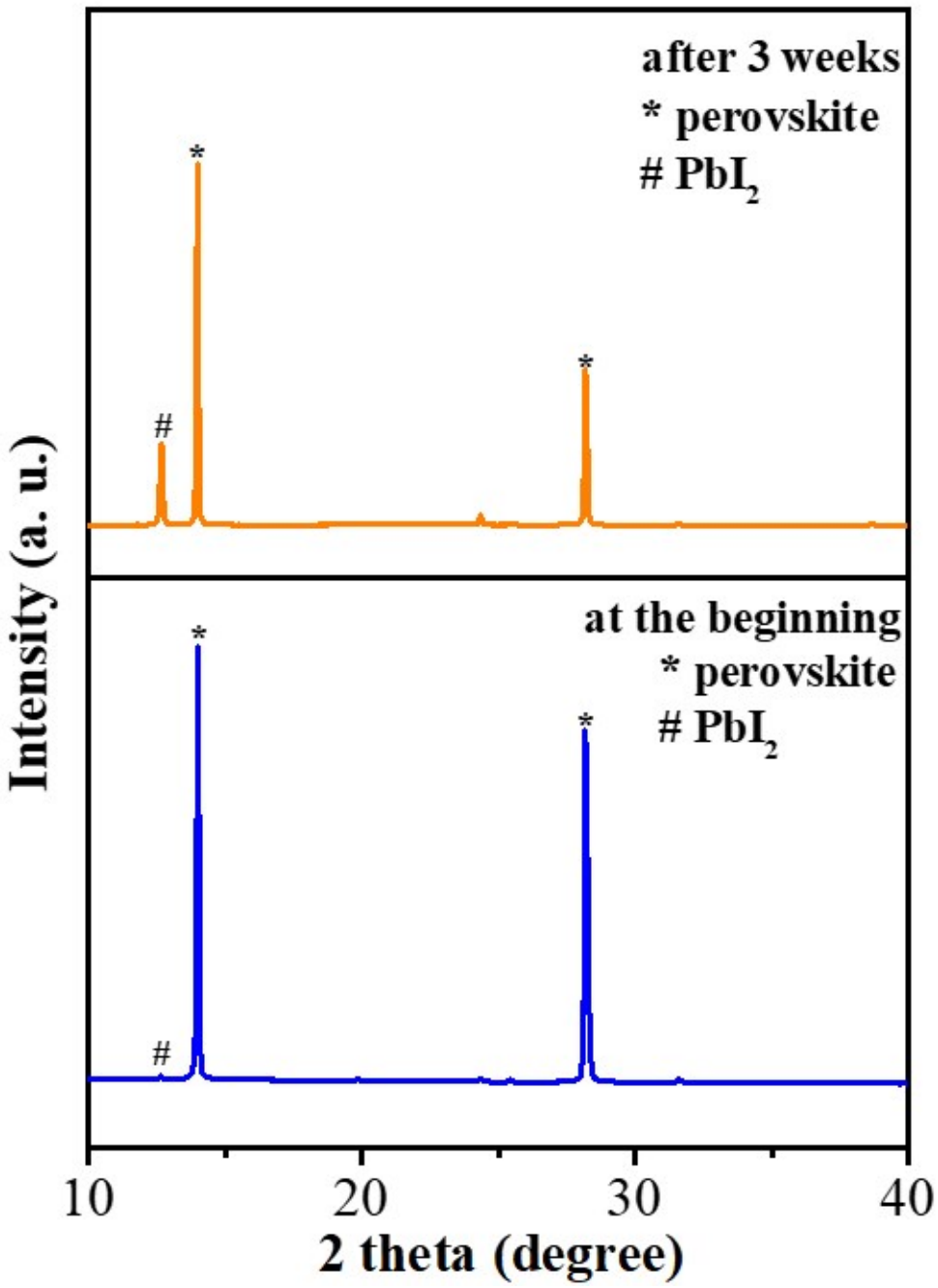

Fig. S3 The XRD patterns of perovskite film on quartz at the beginning and after 3 weeks

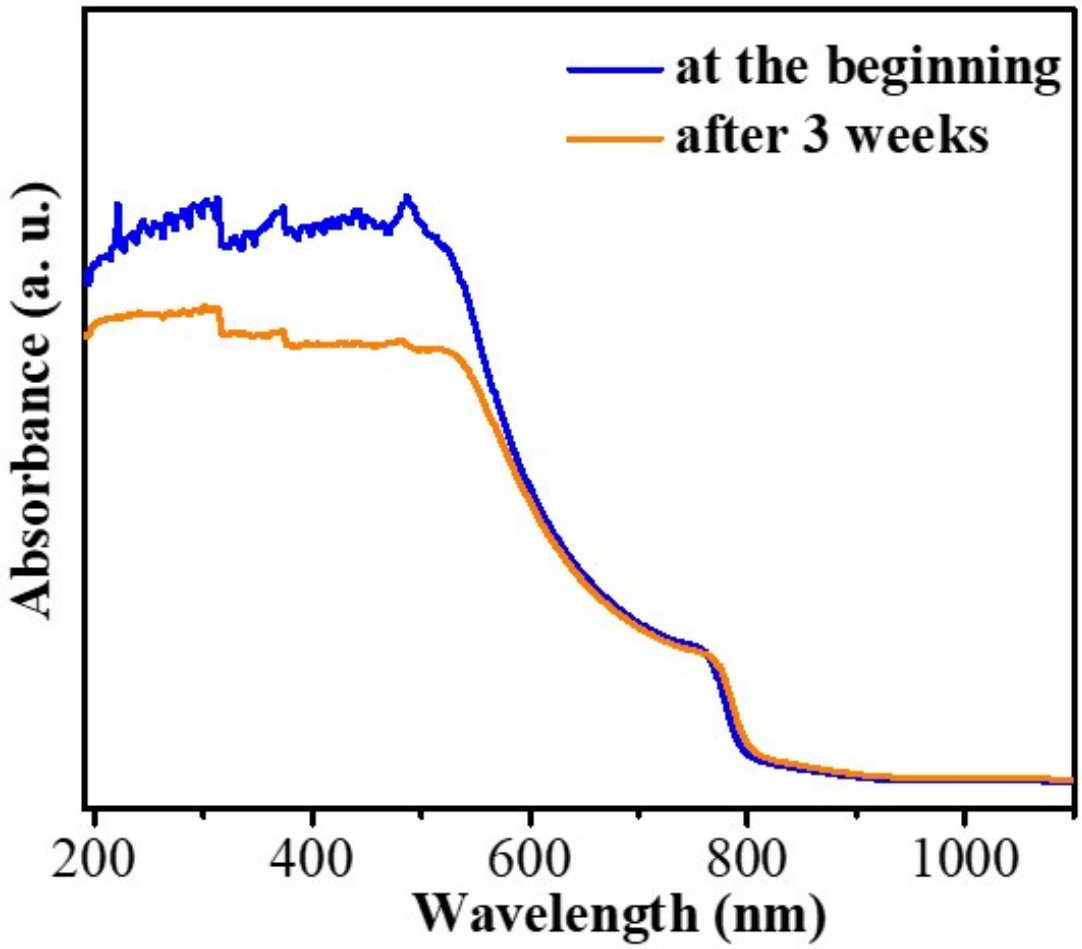

Fig. S4 The UV-vis spectra of perovskite film on quartz at the beginning and after 3 weeks

Table S1. The performance parameters of the photodetector with different bias voltages

Light intensity (mW/cm^2)	**Voltage (V)**	**Responsivity (mA/W)**	**Detectivity (Jones)**	**EQE (%)**
0.774	0	52.36	$4.23x10^{11}$	25.61
0.774	-0.05	50.07	$4.37x10^{10}$	24.49
0.774	-0.1	51.39	$2.33x10^{10}$	25.13
0.774	-0.15	57.28	$1.72x10^{10}$	28.01
0.774	-0.2	76.28	$1.73x10^{10}$	37.31

Table S2. The performance parameters of the photodetector with different light intensities

Light intensity (mW/cm^2)	**Voltage (V)**	**Responsivity (mA/W)**	**Detectivity (Jones)**	**EQE (%)**
1.01	0	44.63	$3.94x10^{11}$	21.83
0.774	0	52.68	$4.65x10^{11}$	25.76
0.577	0	47.78	$4.22x10^{11}$	23.37
0.419	0	42.72	$3.77x10^{11}$	20.89
0.354	0	44.08	$3.89x10^{11}$	21.56