Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Electronic Supplementary Information

Phase-transition-induced superior ultraviolet photodetection of ZnO/VO_2 bilayer

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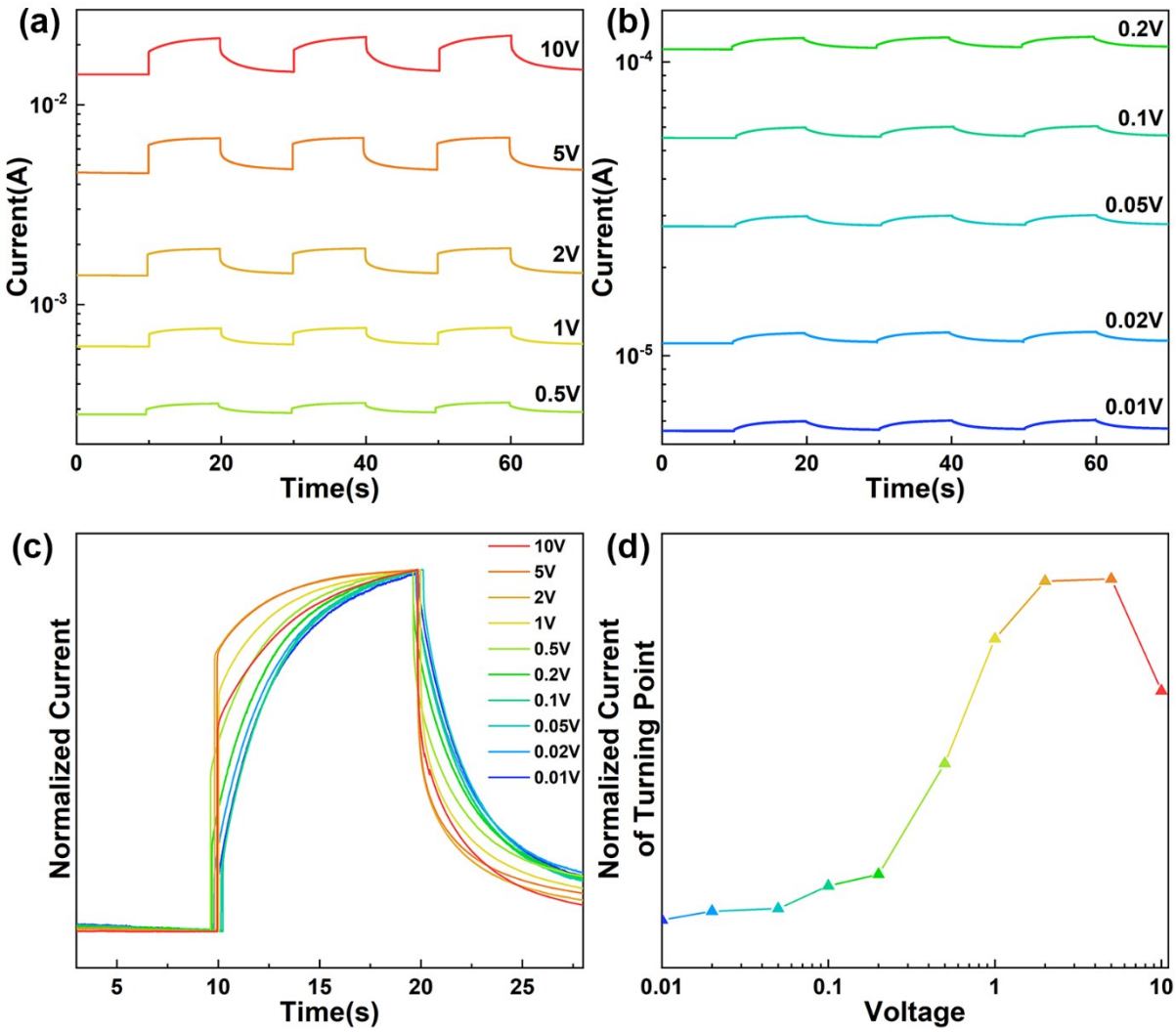

Fig. S1 Photo response of the multilayered film under different biases. (a) and (b) I-t curve under the bias of 10V to 0.01V respectively. (c) Normalization of I-t curves with different biases. (d) Turning points of the normalized curves. All test in this figure is down under room temperature.

The photo responses as a function of the applied bias are shown in Fig. S1a and S1b. To further compare the curves with different biases, we normalized the data and composed the normalized curves into one figure as shown in Fig. S1c. We can see that all the curves compose of two different steps during the rising process, and the turning point of the two steps indicates the rising speed of the curve. Fig. S1dshows the relationship between turning point and the applied bias, in which a bias of 1 V is chosen for further study as it has a rather high response speed while avoids the high voltage.

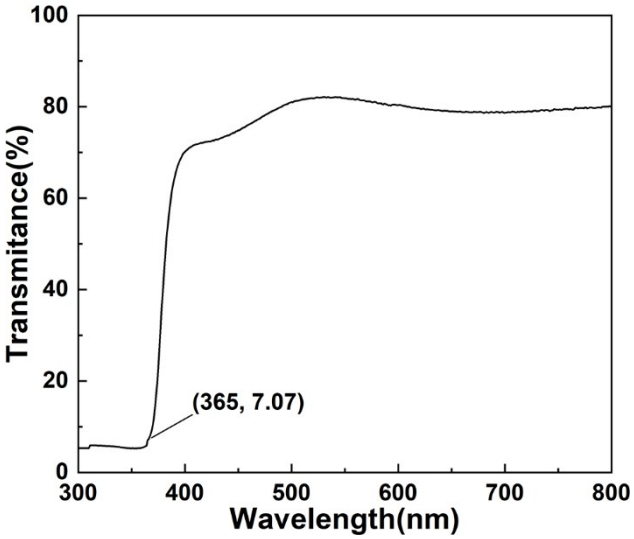

Fig. S2 Transmittance spectrum of the ZnO layer of the device.

Transmittance data of single ZnO film is gathered for EQE and IQE calculation. As shown in Fig. S2, transmittance of ZnO is 7.07 % at the wavelength of 365 nm, thus absorption of ZnO film which is useful for the calculation is 92.97 %.

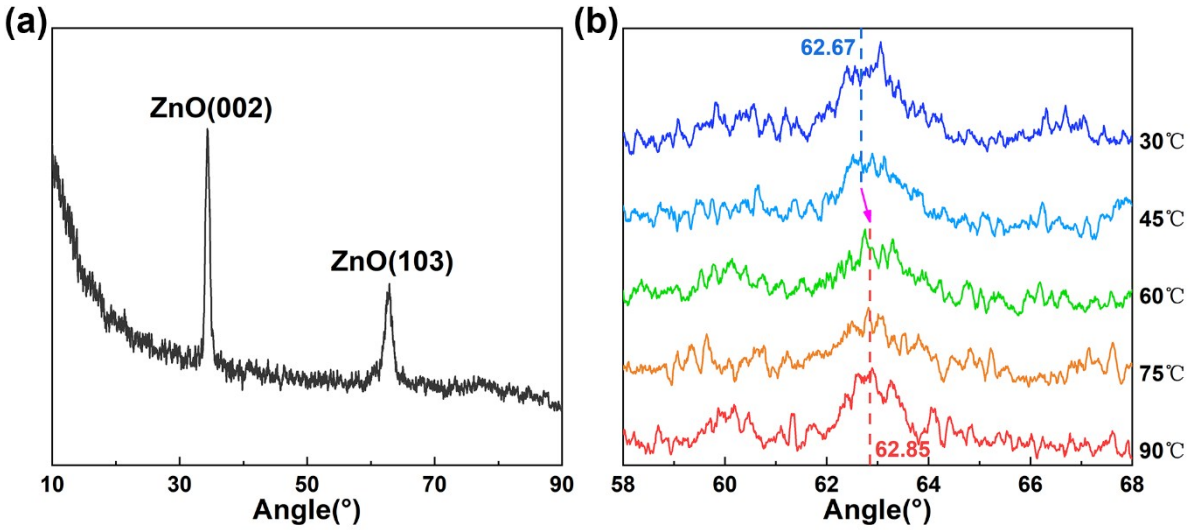

Fig. S3 Glancing angle X-ray diffraction of the multilayered structure. (a) General view of the data. (b) Data under different temperatures, focusing the peak of (103) of ZnO.

In order to confirm the induced stress from the VO_2 film onto the ZnO film, we used glancing angle X-ray diffraction measurement with variable temperatures. The reason of using glancing angle X-ray diffraction is that normal X-ray diffraction measurement cannot detect in-plane crystal plane of ZnO, meanwhile (002) plane of ZnO which can be easily detected is given little stress from the VO_2 film because of its vertical direction. Fig. S3a shows the general view of the data while Fig. S3b focuses the (103) peak of ZnO. In Fig. S3b, lines in different color show the data measured under different temperatures. The data was acquired every 15 ℃, and between 45 ℃ and 60 ℃, the peak shifted right about 0.1 ° which indicates that the phase transition of VO_2 film applied a stress onto the ZnO film.

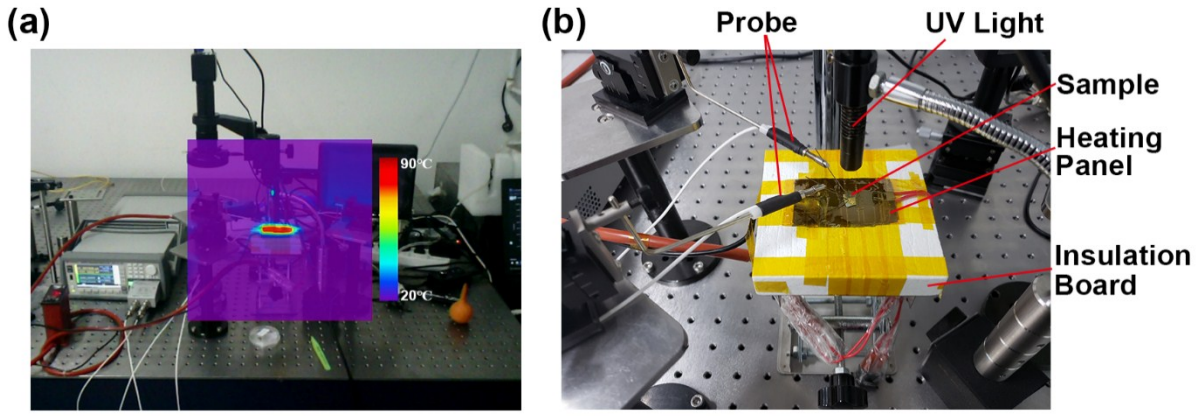

Fig. S4 Photo of the testing devices. (a) Infrared photo of testing device. (b) Close photo of the testing device.

Fig. S4 shows the whole testing devices. The middle of Fig. S4a shows the infrared photo captured by thermal imager. In the infrared photo, we can see that the temperature of the heating panel is even and stable at approximately 80℃. Fig. S4b shows the devices used to measure the photo responsivity under different temperatures.

Table S1 A comparison of responsivity of photodetectors based on ZnO film

Fabrication Method	Responsivity (A W^{-1})	Bias	Wavelength (nm)	Reference
Sputtering	10.07	1 V	365	This Work
MOCVD	1.5	5 V	368	1
Sputtering	18	5 V	365	2
Sputtering	30	3 V	360	3
MBE	0.055	500 V cm^{-1}	362	4
MBE	0.141	10V	370	5
Sol-gel	0.04	5V	350	6
Sputtering	7	10V	260	7
ALD	0.7	5V	370	8

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