electronic supplementary information

Performance Enhancement of ZnMgO Film UV Photodetector by HF Solution Treatment

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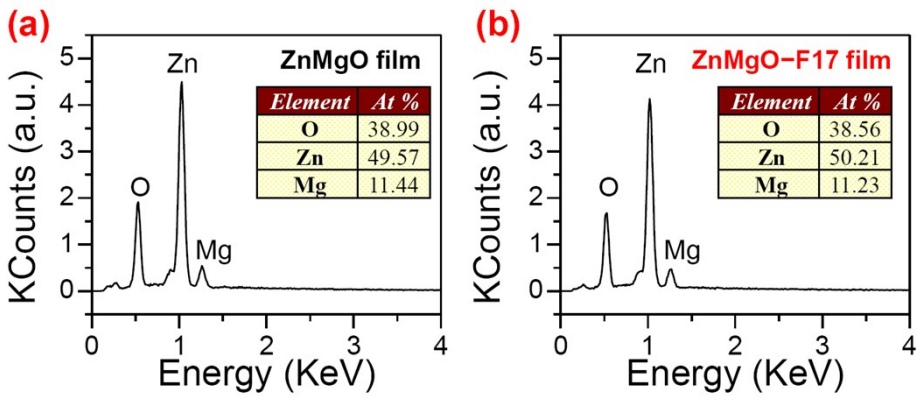

Figure S1. EDS spectra of ZnMgO films. (a) ZnMgO film. (b) ZnMgO−F17 film.

films/devices	acid solutions	$[H^+]$ $mmol \cdot L^{-1}$	at.% of F [a]	*t-decay* (ms)	responsivity (A/W)	*I-dark* (pA)
ZnMgO	no	/	0	4.6	145	0.72
ZnMgO−F6	HF	6	/ [b]	3.1	185	0.65
ZnMgO−F12	HF	12	2.34	1	285	0.52
ZnMgO−F17	HF	17	2.98	0.34	326	0.44
ZnMgO−A12	HAc	12	0	4.5	140	0.61
ZnMgO−C12	HCl	12	0	4.2	150	0.78

a:The atom percentage of the F species on the surface of the films were determined by the XPS.

b: The XPS analysis of this film did not performed.

Table S1. The photoresponse parameters between the devices which were treated by various acid solutions.

It can be seen that, when the device are treated by HCl and CH_3COOH with same H^+ concentration of HF, the 90−10% decay time is not changed obviously. Whereas, the device treated by HF has a smaller *t-decay*. After that, the device are treated by a series of HF solutions with different concentration, and the results show that when the concentration become higher, the value of F species on the surface increases (detected by XPS), and the *t-decay* become smaller. On the basis of these photoresponse parameters, the following disclosures can be made that the F affected the surface of the ZnMgO films, and improved the response speed. Moreover, the responsivity of the devices become higher and the dark current become lower with the increasing of the concentration of the HF solution.

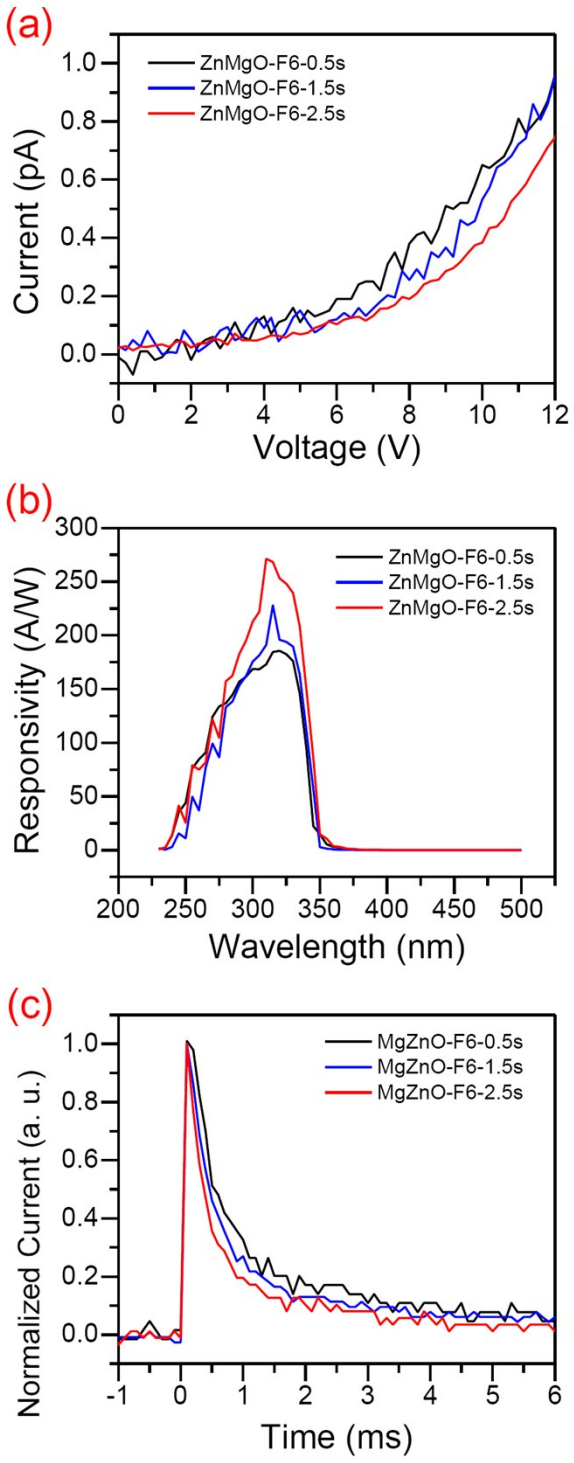

Figure S2. The photoresponse parameters between the devices which were treated by HF in different time. (HF: $[H^+]$=6 mmol·L^{-1}, treatment time=0.5 s; 1.5 s; 2.5 s). (a) I−V characteristics of devices in dark. (b) Spectral responses of the devices under bias of 10 V. (c) Decay edge of the current response at bias of 10 V.

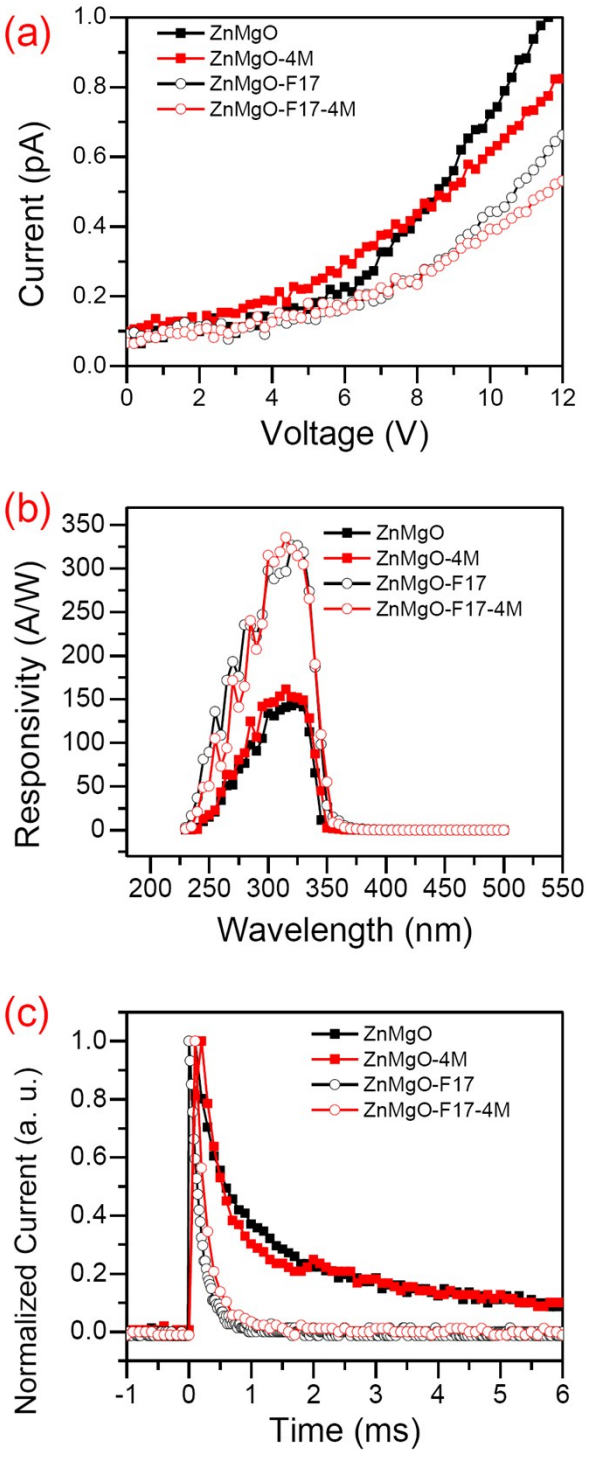

Figure S3. The photoresponse parameters between the new devices and the devices which were stored in electronic humidity control box (temperature=25 ± 1 °C, humidity<3%) for 4 months.

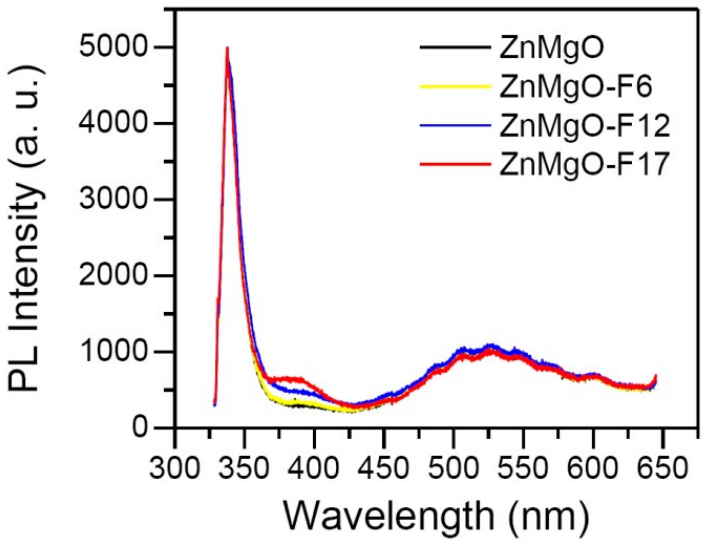

Figure S4. Photoluminescence plots for the ZnMgO film treated by different concentration of H+ (HF: $[H^+]$=6 mmol·L^{-1}, 12 mmol·L^{-1}, 17 mmol·L^{-1})