Electronic Supplementary Material (ESI) for Nanoscale.
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Supporting Information

Surface Conversion of ZnO Nanorod to ZIF-8 to Suppress Surface Defects for Visible-Blind UV photodetector

Hyeonghun Kim[a], Woochul Kim[a], Jiyoon Park[a], Namsoo Lim[a], Ryeri Lee[a], Sung Jun Cho[a], Yogeenth Kumaresan[a], Myoung-kyu Oh[*b], Gun Young Jung[*a]

[a] *School of Materials Science and Engineering, Gwangju Institute of Science and Technology (GIST), 123 Chemdangwagi-ro, Buk-gu, Gwangju 61005, Republic of Korea.*

[b] *Advanced Photonics Research Institute (APRI), Gwangju Institute of Science and Technology (GIST), Gwangju 61005, South Korea.*

[*] Address correspondence to omkyu@gist.ac.kr, gyjung@gist.ac.kr.

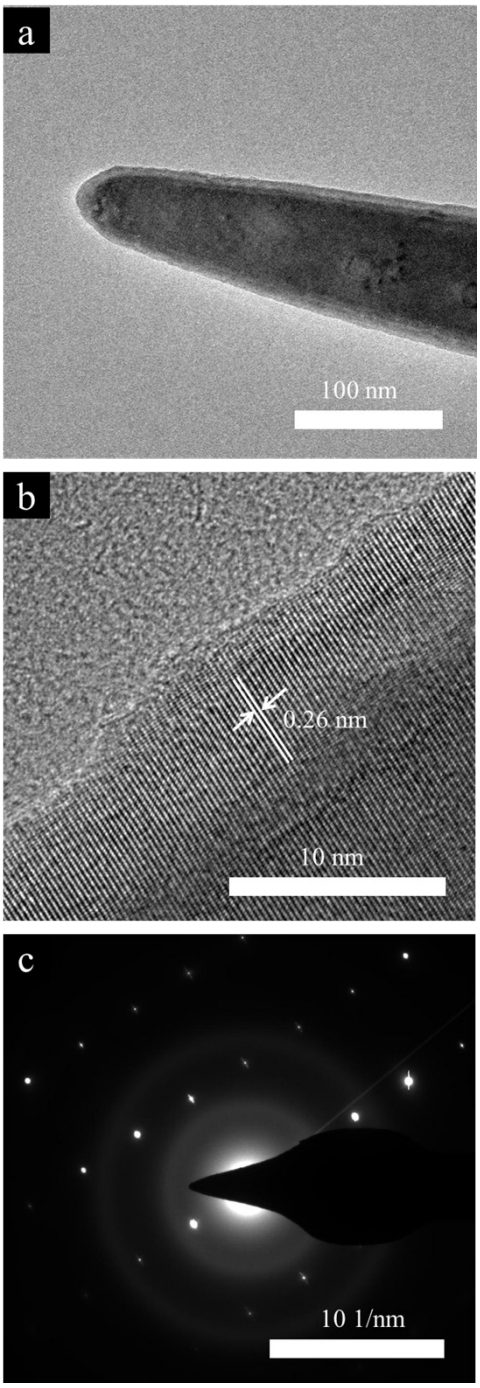
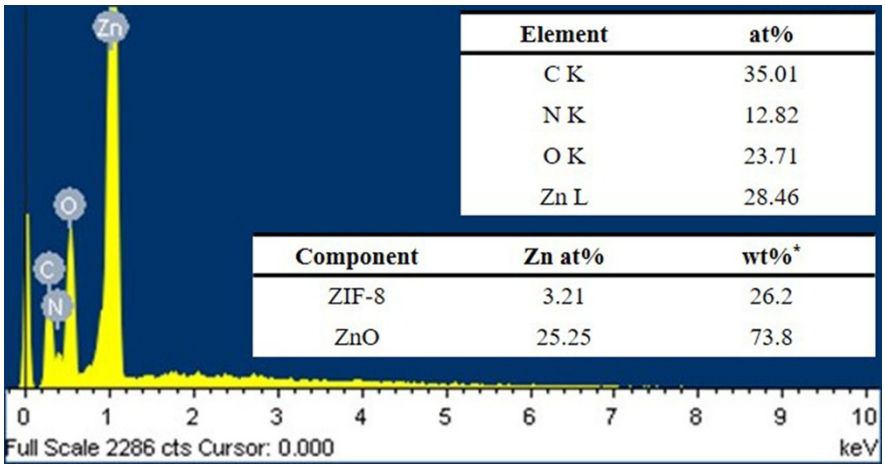


Fig. S1 (a) A TEM image, (b) HR-TEM image, and (c) SAED pattern of the ZnO NR.



Element	at%
C K	35.01
N K	12.82
O K	23.71
Zn L	28.46

Component	Zn at%	wt%*
ZIF-8	3.21	26.2
ZnO	25.25	73.8

* wt% of ZIF-8 = 100 (%) × 227.58 / (227.58 + 7.87 × 81.38) = 26.2 wt%,
wt% of ZnO = 100 - wt% of ZIF-8 = 73.8 wt%

Fig. S2 SEM-EDX spectrum of the 50-ZnO@ZIF-8 NRs.

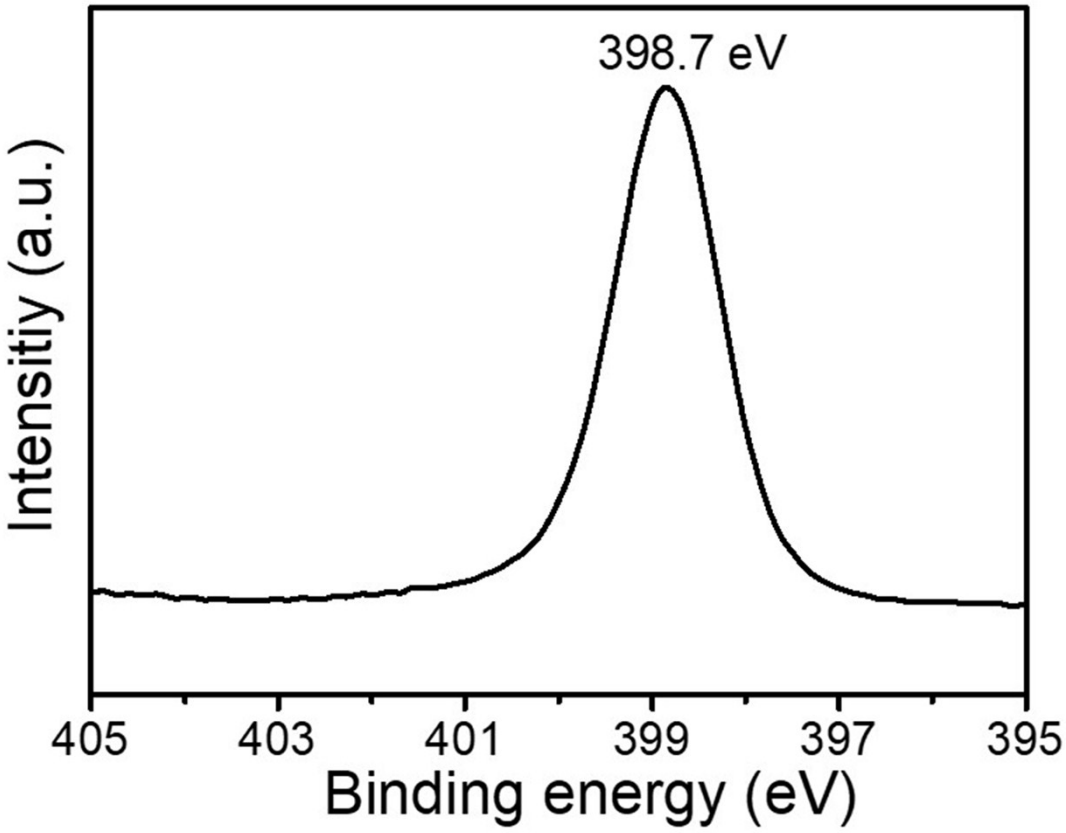


Fig. S3 (a) Narrow N1s XPS spectrum of the ZnO@ZIF-8 NRs.

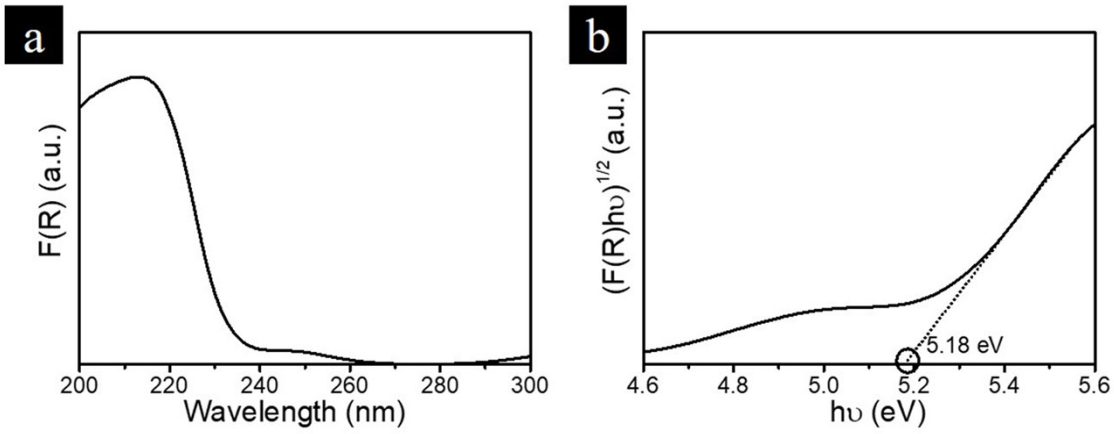


Fig. S4 (a) K-M function spectrum of the bare ZIF-8 film and (b) its corresponding Tauc plot.

Growth of ZIF-8 film on Si substrate

An n^+ Si substrate was cleaned with acetone, isopropyl alcohol and DI in sequence and subjected to UV-ozone treatment. The substrate was dipped into a 50 ml of methanolic solution containing 12.5 mM of $Zn(NO_3)_2 \cdot 6H_2O$ and 25 mM of Hmim for 30 min. After completing the reaction, the sample was washed with methanol and blow-dried with a nitrogen gun. This process was repeated 7 times to have 600 nm-thick ZIF-8 film. The sample was annealed at 200 °C for 1 hr under air atmosphere to vaporize the methanol captured within the micropores of ZIF-8 film.

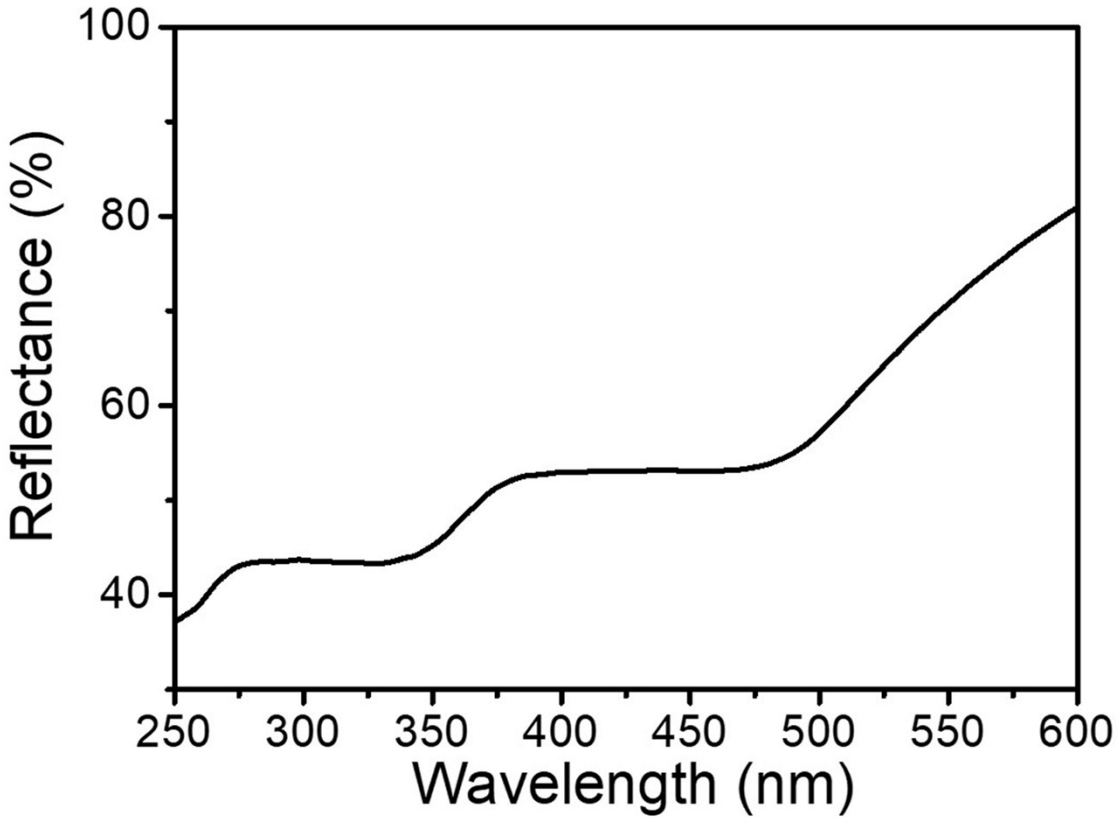


Fig. S5 (a) UV-Visible reflectance spectrum of 30 nm-thick Au (30 nm) on a Si substrate.

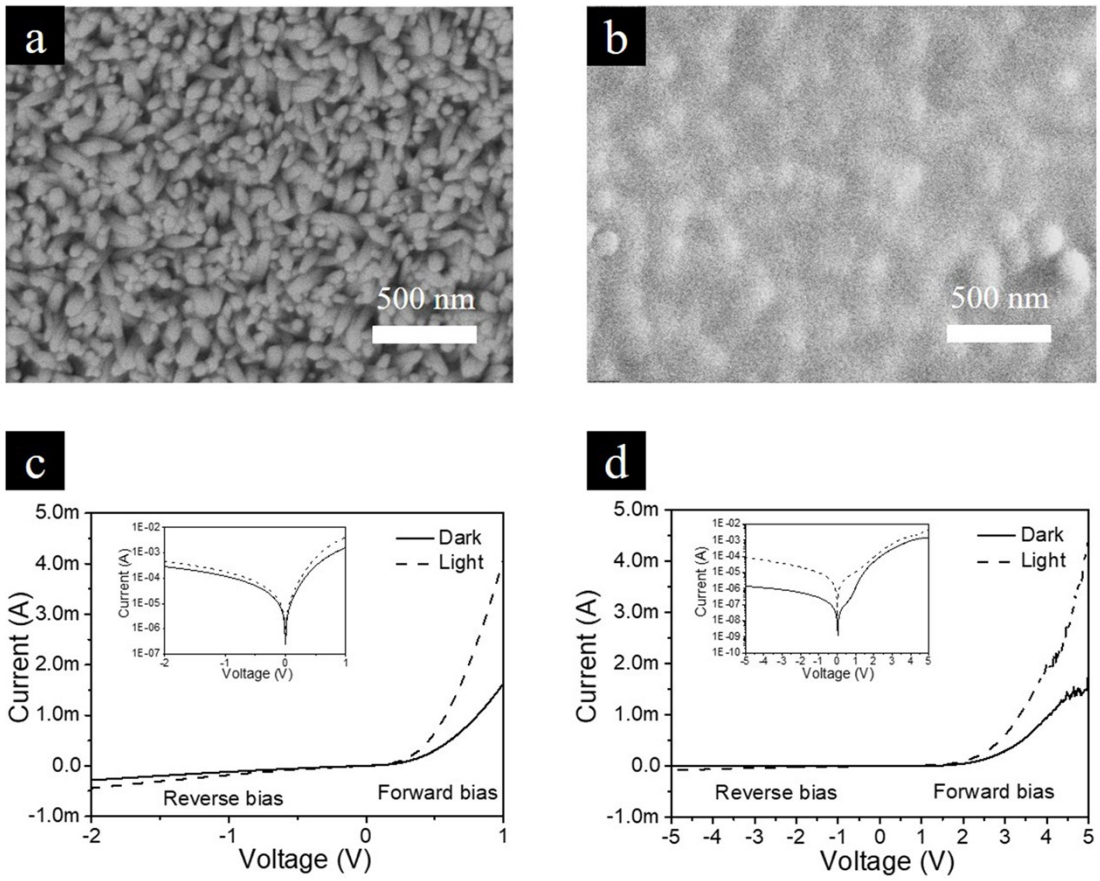


Fig S6 SEM images of the top Au electrode deposited on the (a) ZnO NRs and (b) PMMA-ZnO NRs. I-V curves (inset: log scale) of the (c) ZnO NRs and (d) PMMA-ZnO NRs PDs in dark and under illumination of 365 nm (irradiance of 1 $mWcm^{-2}$).

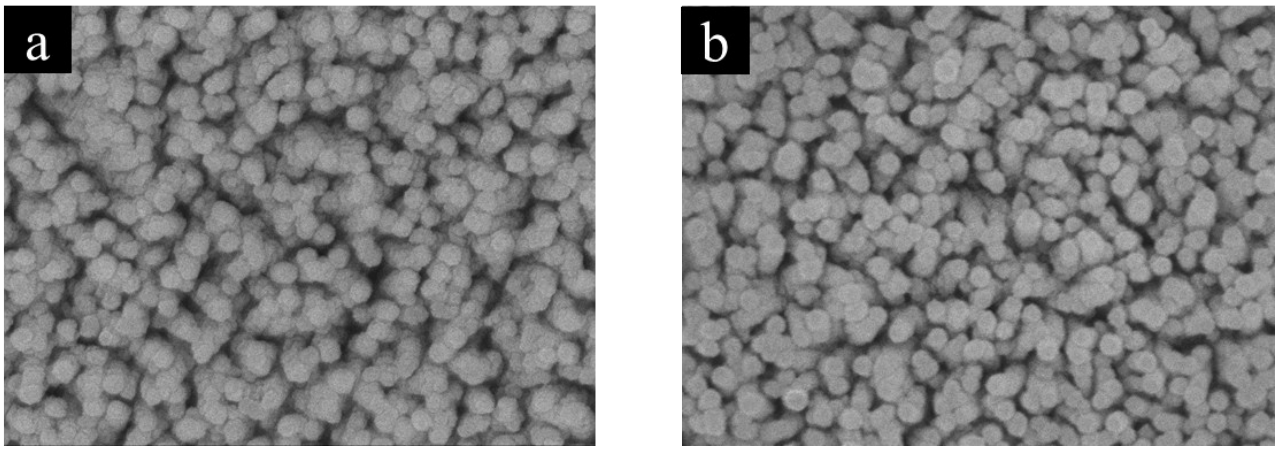


Fig. S7 SEM images of the top electrode deposited on the (a) 5-ZnO@ZIF-8 NRs and (b) 20-ZnO@ZIF-8 NRs

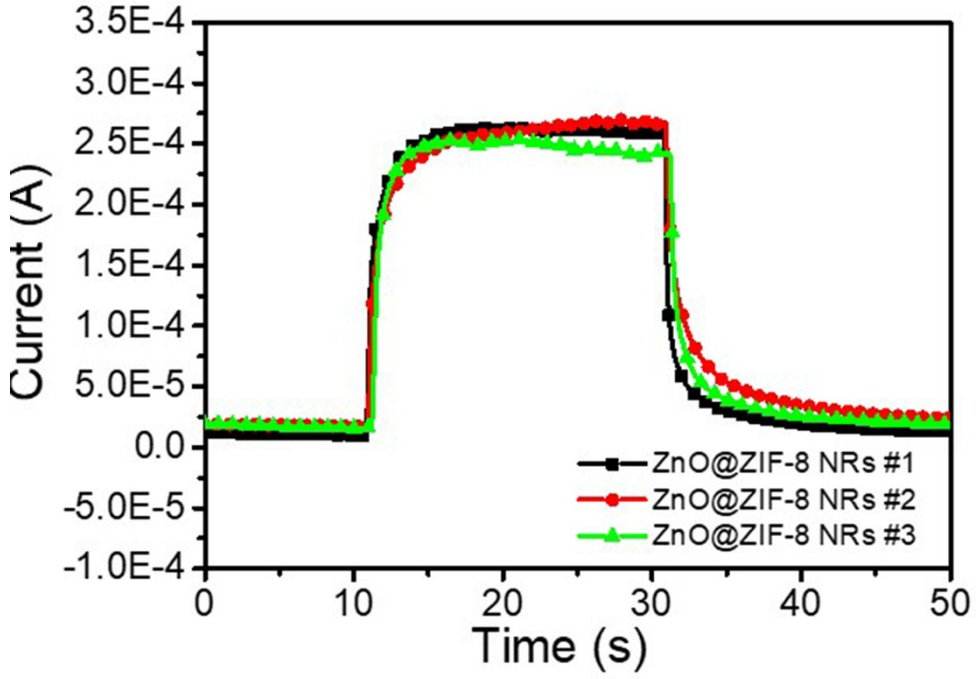


Fig. S8 Reliability test; photoresponses of three different ZnO@ZIF-8 NRs PDs under an irradiance of 0.5 mW cm^{-2}.

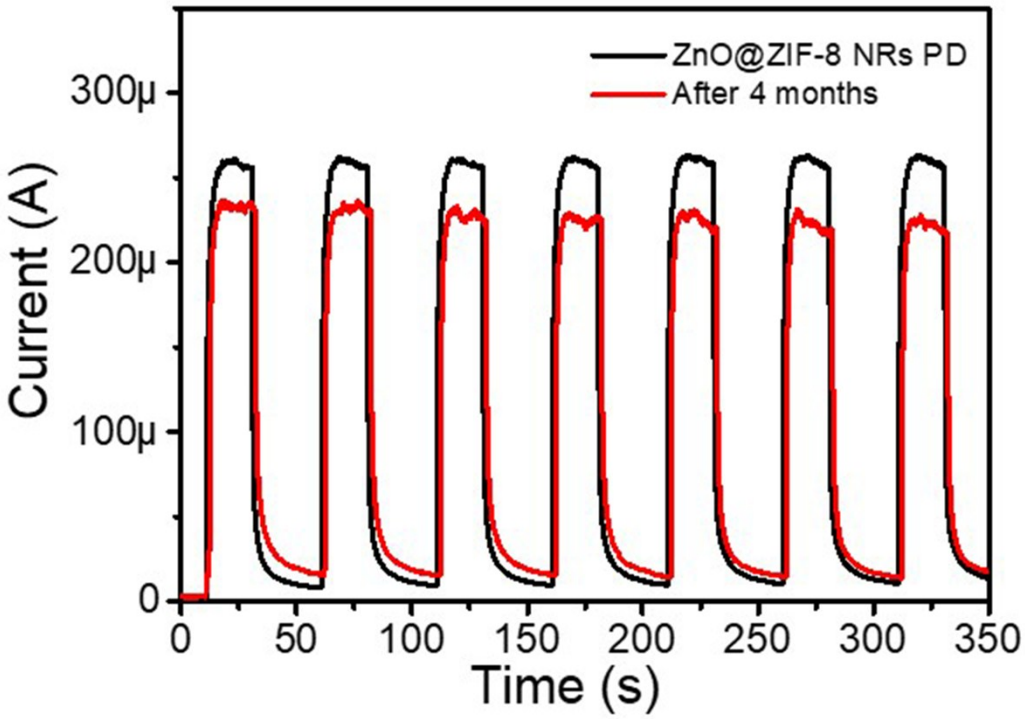


Fig. S9 Stability test; photoresponse of the fresh ZnO@ZIF-8 NRs PD and after 4 months storage in air under repeated illumination cycles (irradiance of 0.5 mW cm^{-2}, 20 sec on and 30 sec off).

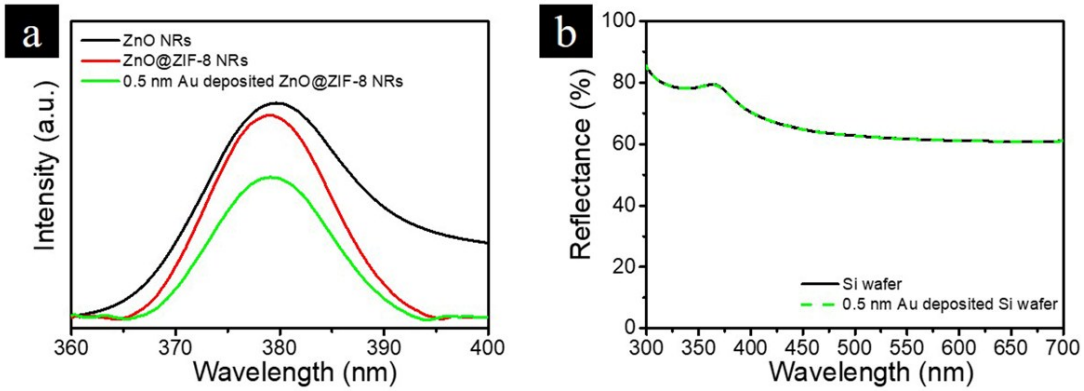


Fig. S10 (a) PL spectra of the ZnO NRs and ZnO@ZIF-8 NRs with and without 0.5 nm-thick Au film under 325 nm laser exposure. (b) UV-Visible reflectance spectra of a Si wafer with and without the 0.5 nm-thick Au film.

Table S1 Previously reported ZnO based-UV photodetectors and their PD performances

Photodetector	Synthesis	Device structures	UV source (nm)	Rise/Decay times (s)	Responsivity (A W^{-1})	Ref.
ZnO film	Sol-gel	Parallel	350	69/120	0.028	S1
BiOCl/ZnO	Sol-gel	Parallel	350	26/11.2	0.18	S1
Ultra-porous ZnO film	Flame spray pyrolysis	Parallel	370	250/150	13	48
ZnO nanorod	Hydrothermal	Parallel	365	100/120	-	S2
ZnO nanorod	Hydrothermal	Parallel	370	-	86	S3
ZnO nanofiber	Electospinning	Parallel	360	31/30	-	S4
Ag-doped ZnO nanofiber	Electospinning	Parallel	360	6.6/3.0	-	S4
ZnO nanorod	Hydrothermal	Vertical	365	4/230	4800	19
ZnO nanorod/p-si	Hydrothermal	Vertical	370	0.022/0.033	0.6	S5
ZnO@ZIF-8 nanorods	Hydrothermal	Vertical	365 295	1.4/1.6	105 291	This work

References

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