# Electronic Supplementary Information

# Enhanced Performance of ZnO Microwire/PEDOT:PSS Heterojunction Ultraviolet Photodetectors via Carbon Nanohorns and DMSO Treatment

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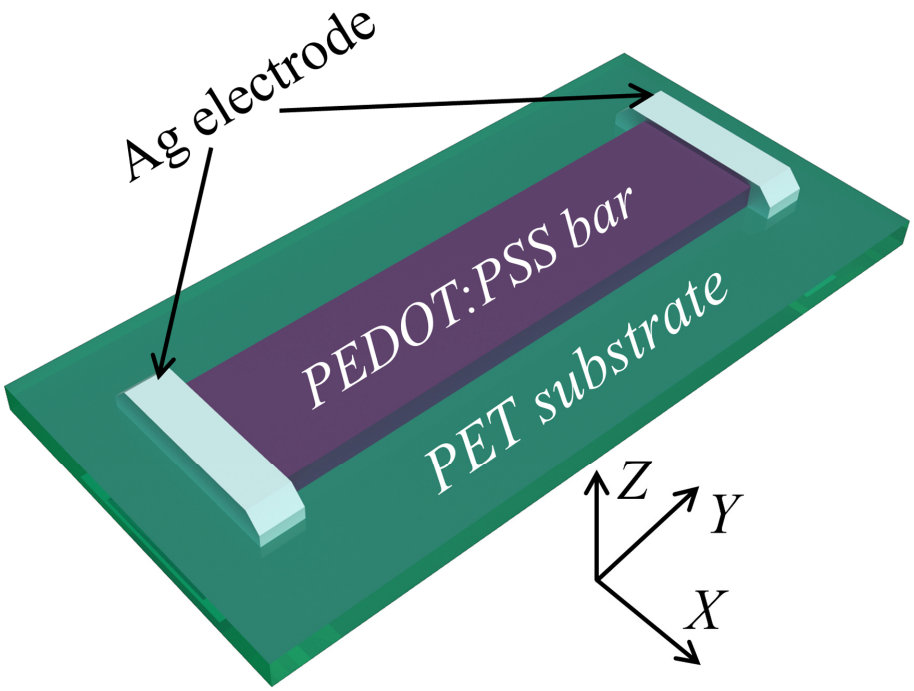


**Figure S1.** Schematic diagram of the microribbon-like PEDOT:PSS device, with Ag pastes working as the symmetrical electrodes.

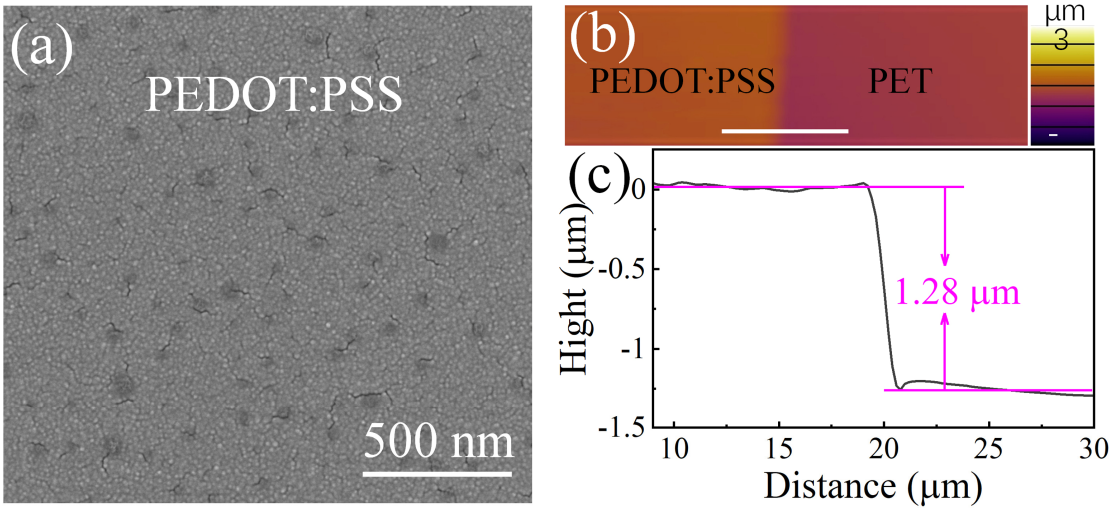


**Figure S2**. (a) SEM photograph of the PEDOT:PSS sample. (b) AFM result of the PEDOT:PSS sample (The scale bar is 4 mm). (c) Height profile along the scale bar in AFM image.

**Table S1.** Parameters of the bar samples.

| Doping volume (μL) | $x$ (mm) | $y$ (mm) | $z$ (μm) | $G$ (S) | $\sigma$ (S/m) |
|---|---|---|---|---|---|
| 0 | 0.571 | 1.76 | 0.829 | $1.47\times10^{-5}$ | 54.7 |
| 5 | 0.456 | 2.04 | 1.32 | $1.96\times10^{-4}$ | 668.8 |
| 10 | 0.552 | 2.28 | 1.07 | $6.14\times10^{-5}$ | 2375.4 |
| 20 | 0.577 | 2.23 | 1.01 | $1.49\times10^{-3}$ | 5708.0 |
| 30 | 0.413 | 1.97 | 0.958 | $1.71\times10^{-3}$ | 8497.3 |
| 40 | 0.727 | 2.59 | 1.08 | $3.16\times10^{-3}$ | 10394.3 |

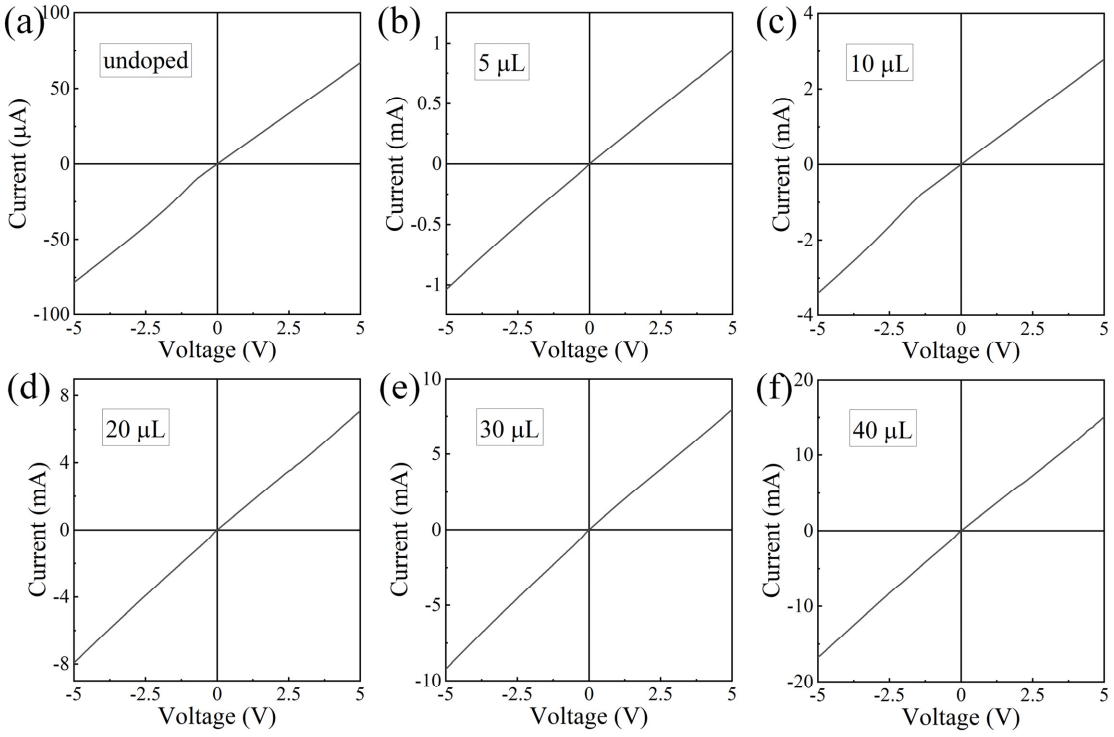


**Figure S3.** *I-V* curves of the microribbon-like PEDOT:PSS device. In the device structure, the doping concentration of DMSO incorporated in PEDOT:PSS samples can be modulated by varying the volume of DMSO solution (a) 0 μL, (b) 5 μL, (c) 10 μL, (d) 20 μL, (e) 30 μL and (f) 40 μL.

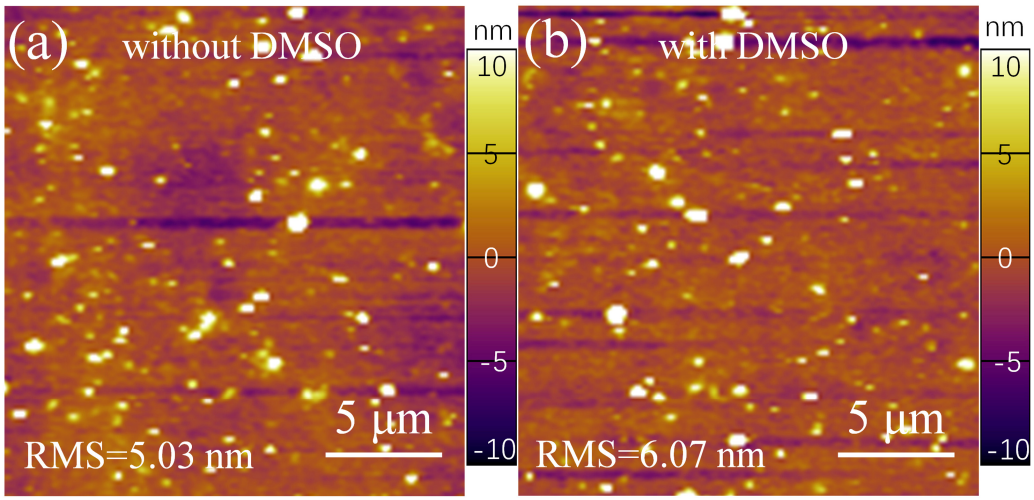


**Figure S4.** AFM images of the PEDOT:PSS film untreated (a), and treated by DMSO (b).

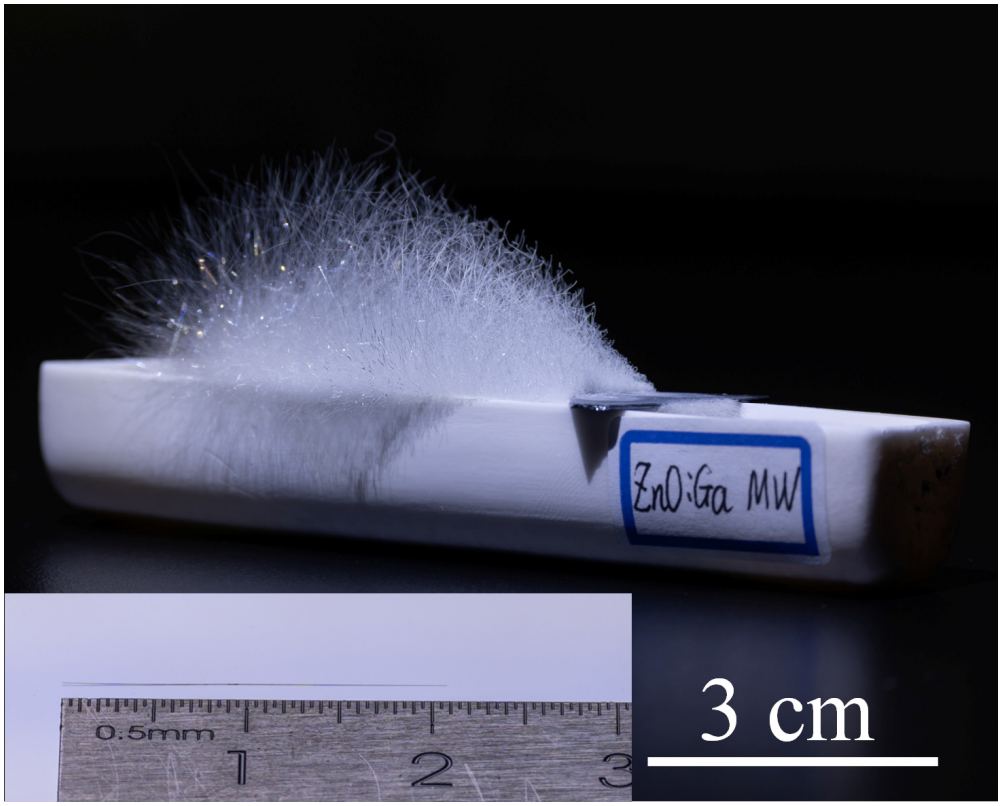


**Figure S5.** Optical photograph of the as-fabricated ZnO:Ga MW. The inset exhibits an optical image of an individual ZnO:Ga wire.

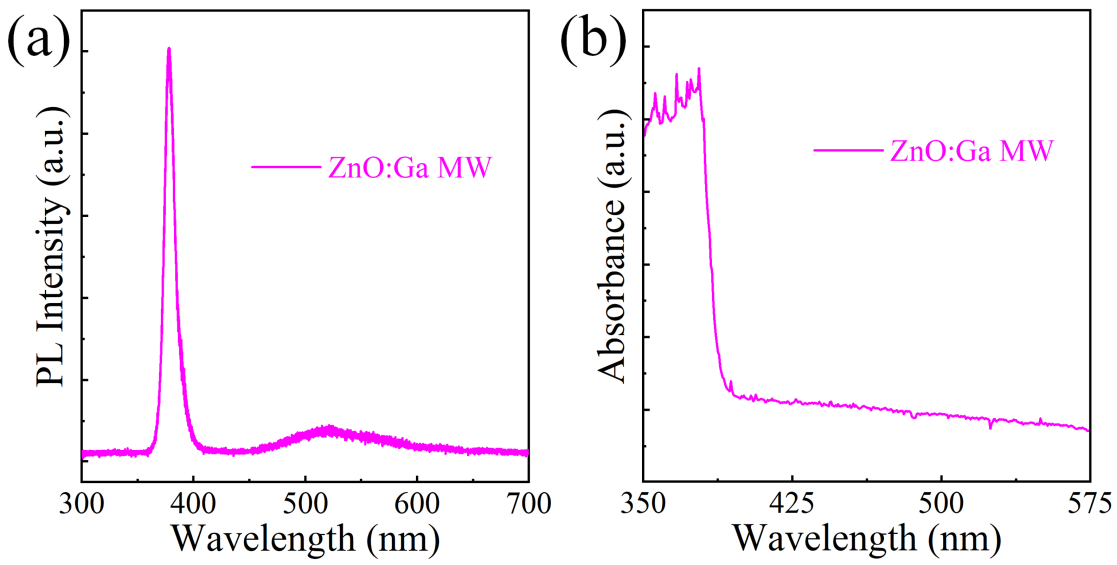


**Figure S6.** (a) PL spectrum of a ZnO:Ga MW. The excitation source is a 325 nm He-Cd laser. (b) Normalized absorbance spectrum of a single ZnO:Ga MW.

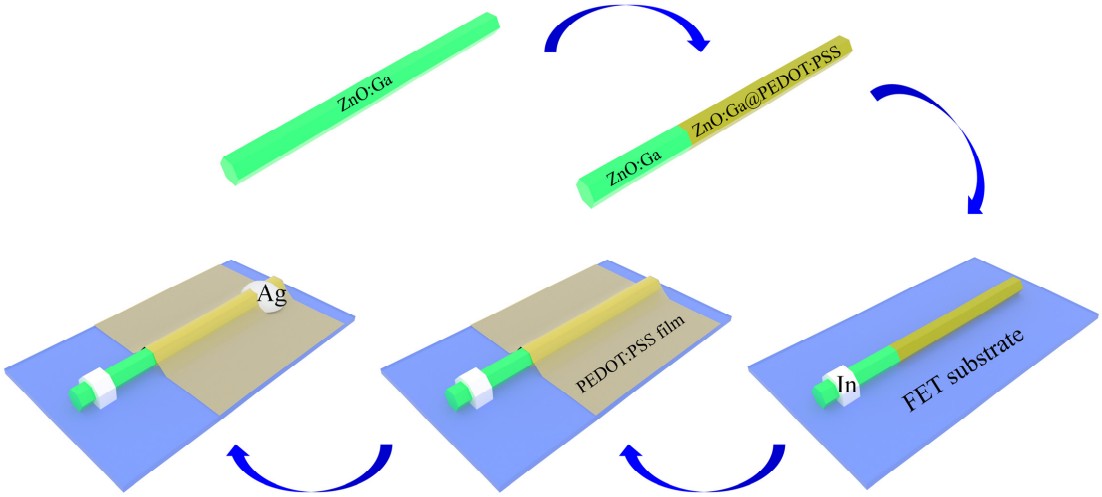


**Figure S7.** Schematic diagram of the fabrication process of the n-ZnO:Ga MW/p-PEDOT:PSS heterojunction device.

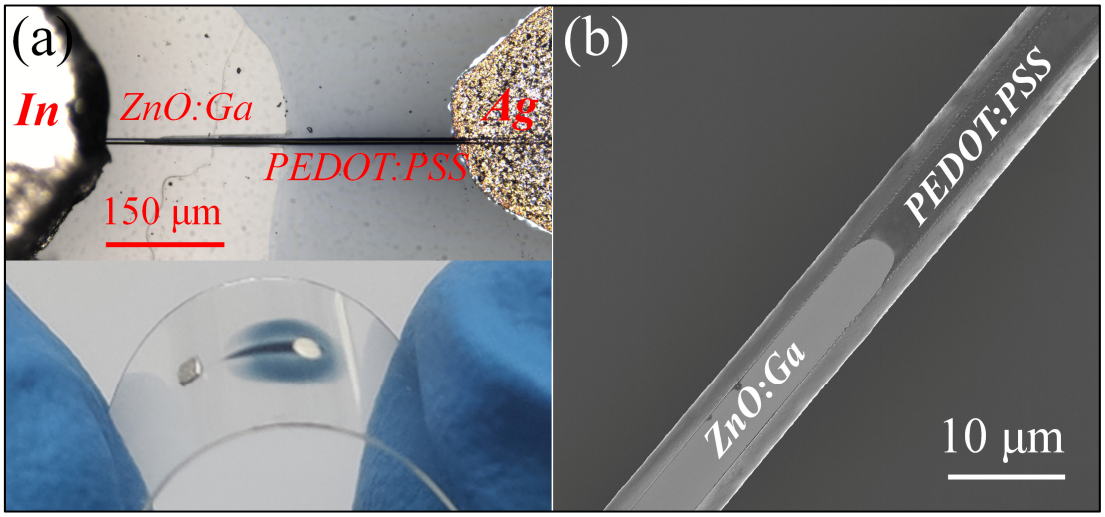


**Figure S8.** (a) Microscopic image (upper) and the corresponding optical photograph (down) of as-prepared n-ZnO:Ga MW/p-PEDOT:PSS heterojunction device. (b) SEM image of a single ZnO:Ga MW, in which the critical region of the wire was uncovered and covered by PEDOT:PSS.

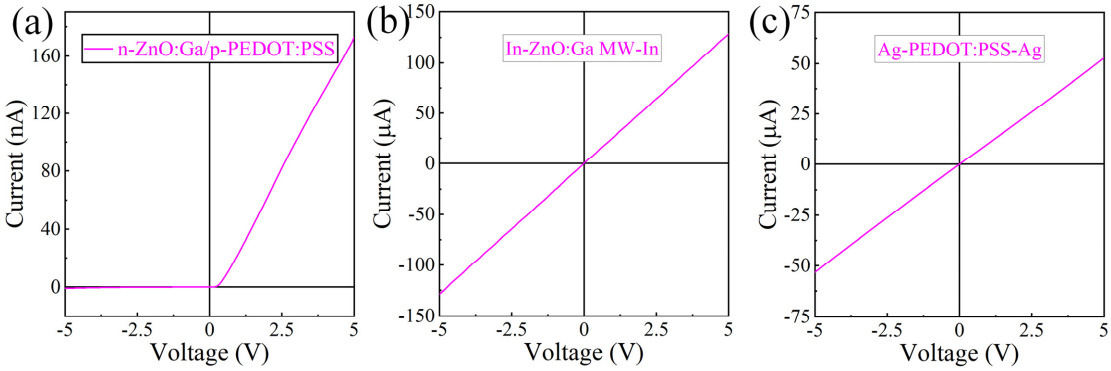


**Figure S9.** *I-V* characteristics of the fabricated (a) n-ZnO:Ga MW/p-PEDOT:PSS heterostructure device in dark, (b) In-ZnO:Ga-In, and (c) Ag-PEDOT:PSS-Ag structures. In the devices structure, the PEDOT:PSS sample was untreated.

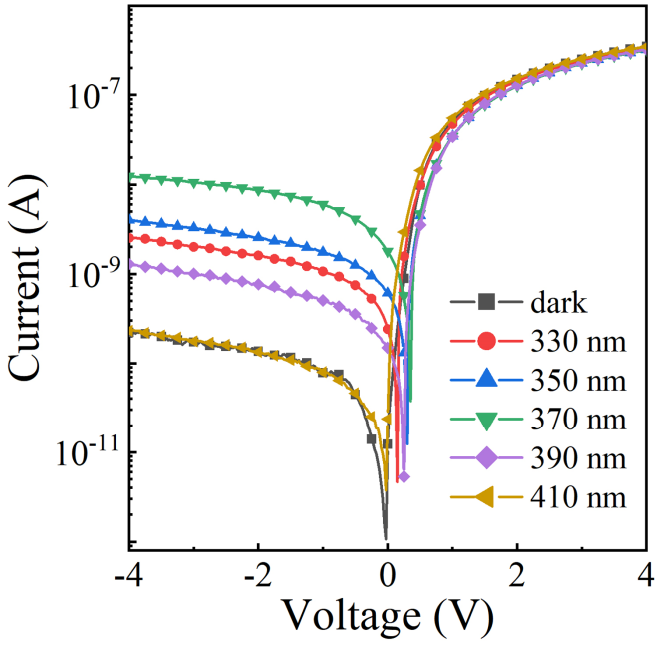


**Figure S10.** *I-V* curves of the n-ZnO:Ga MW/p-PEDOT:PSS heterostructure device under the ultraviolet light illumination with various wavelengths.

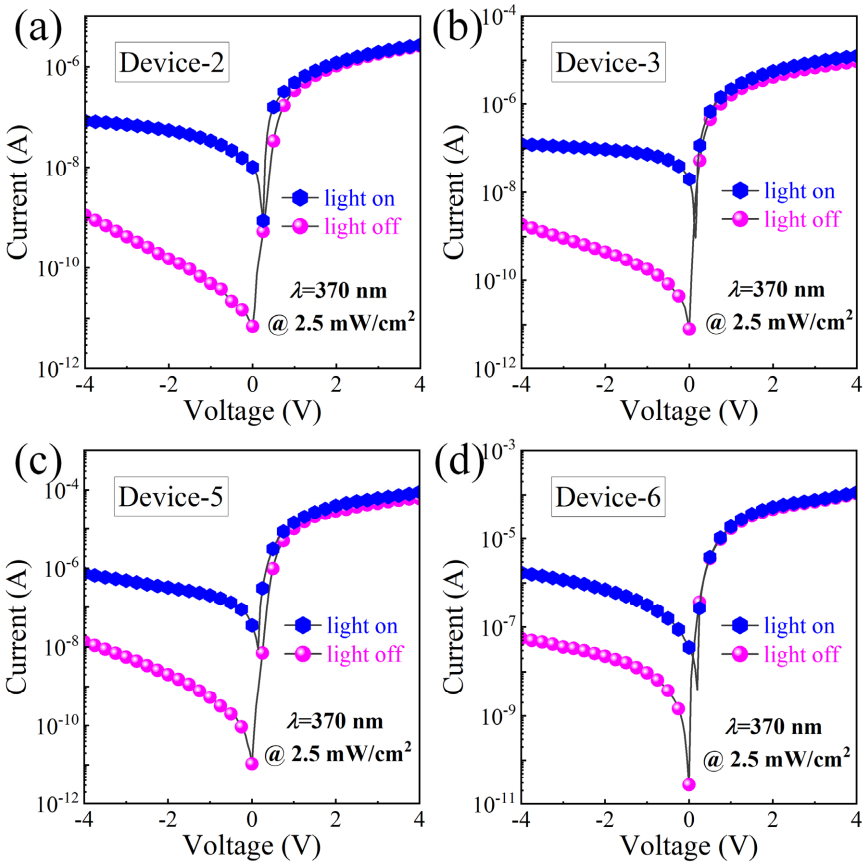


**Figure S11.** *I-V* curves of (a) Device-2, (b) Device-3, (c) Device-5 and (d) Device-6 in darkness and under 370 nm illumination with the light power density of 2.5 mW/cm$^2$.

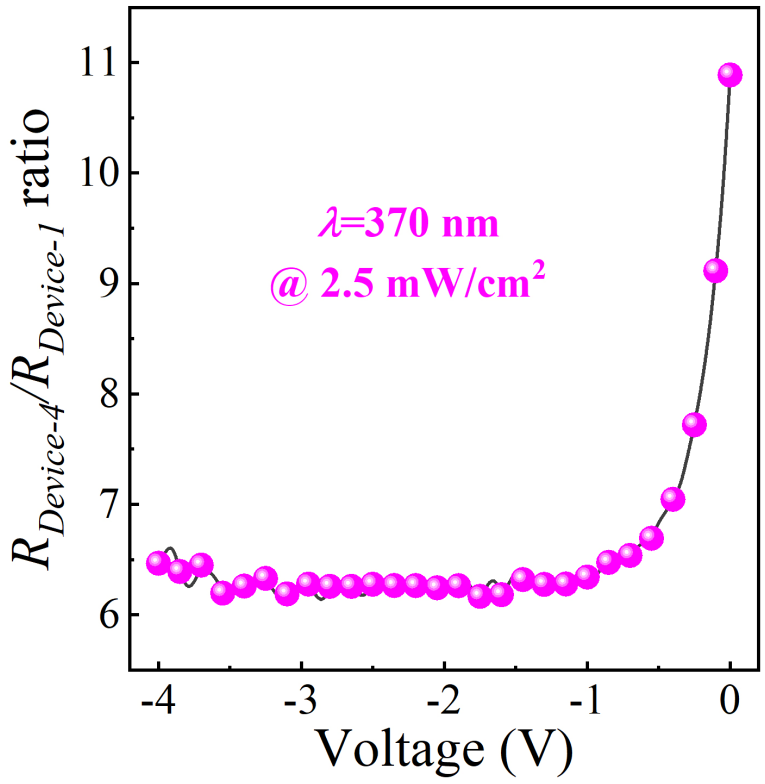


**Figure S12.** Enhancement ratio of the responsivities of the devices under 370 nm irradiation.

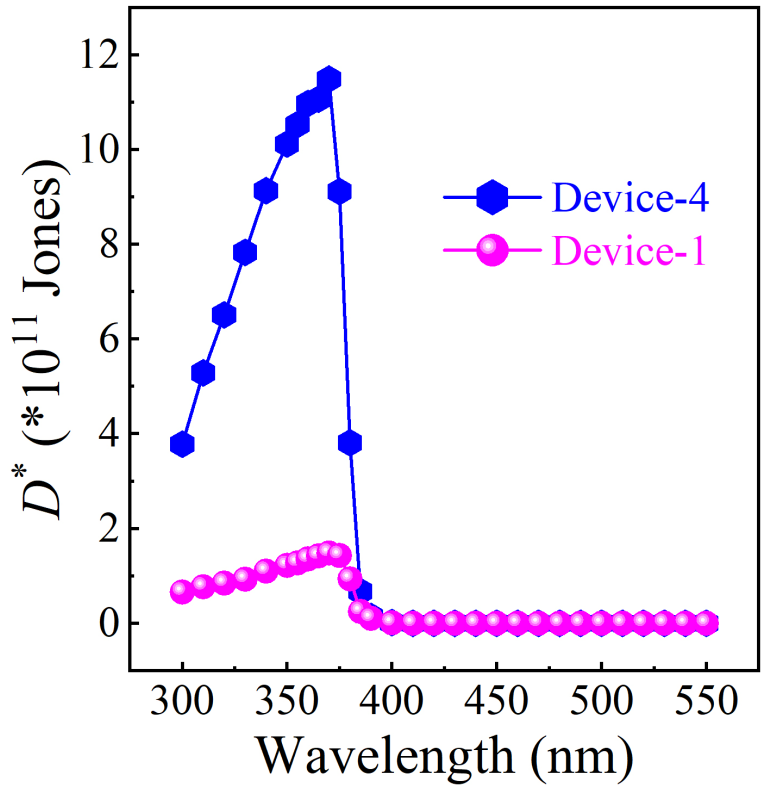


**Figure S13.** Wavelength-dependent detectivities of Device-1 and Device-4.

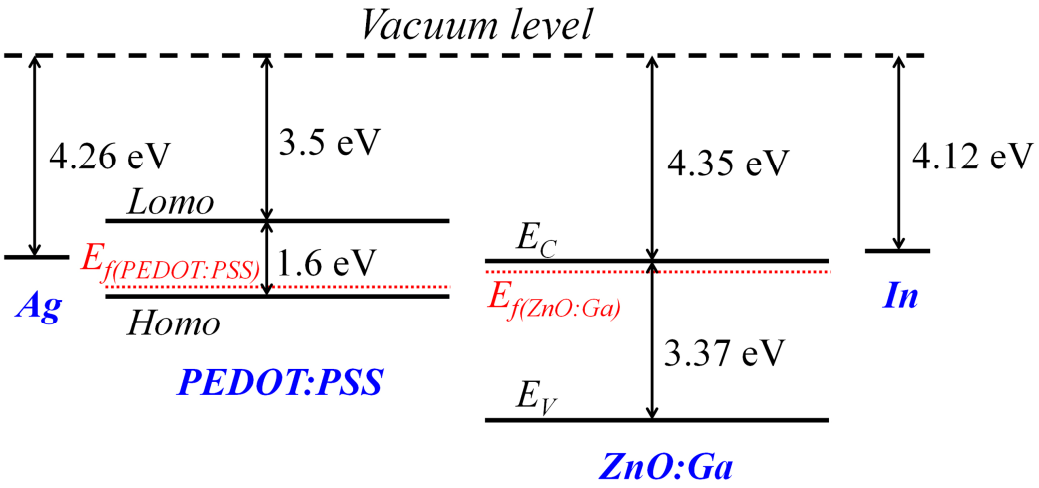


**Figure S14.** Energy band structure of the isolated components for the n-ZnO:Ga MW/p-PEDOT:PSS heterojunction photodetector.

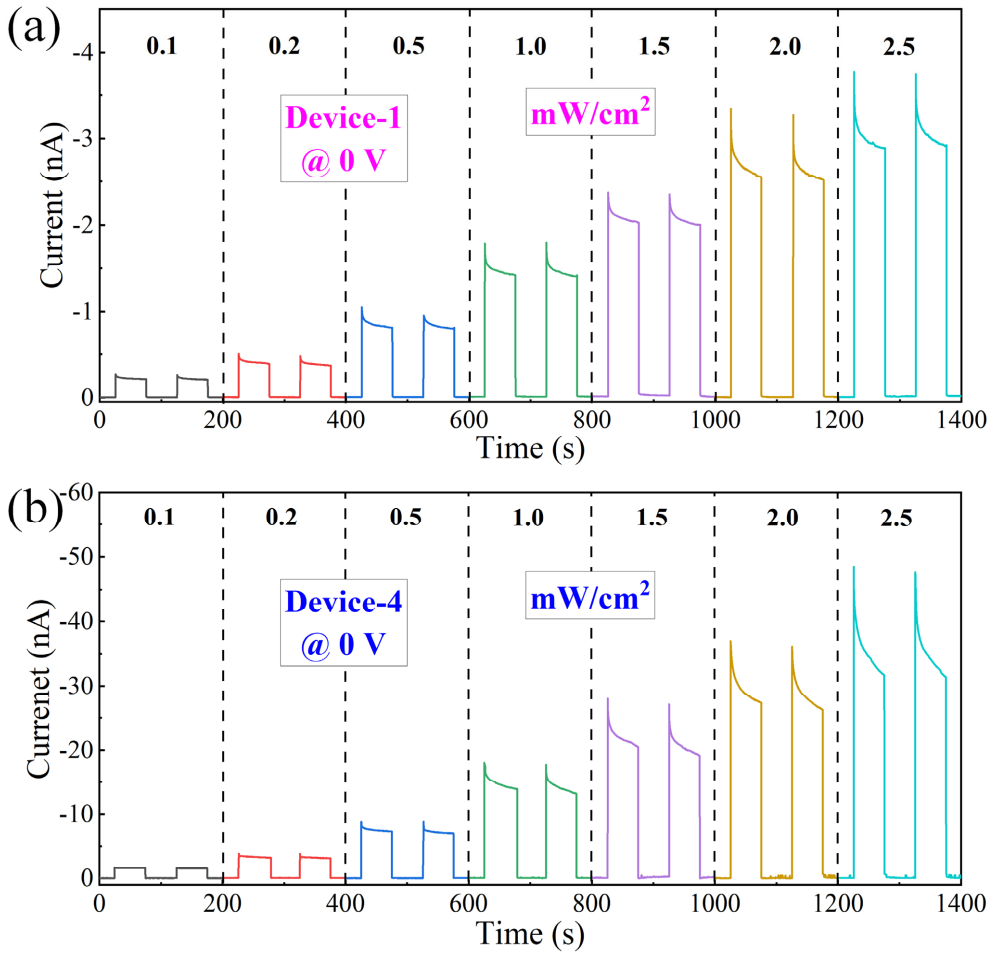


**Figure S15.** *I-t* curves of (a) Device-1 and (b) Device-4 with the irradiated light switch on and off under various power densities.

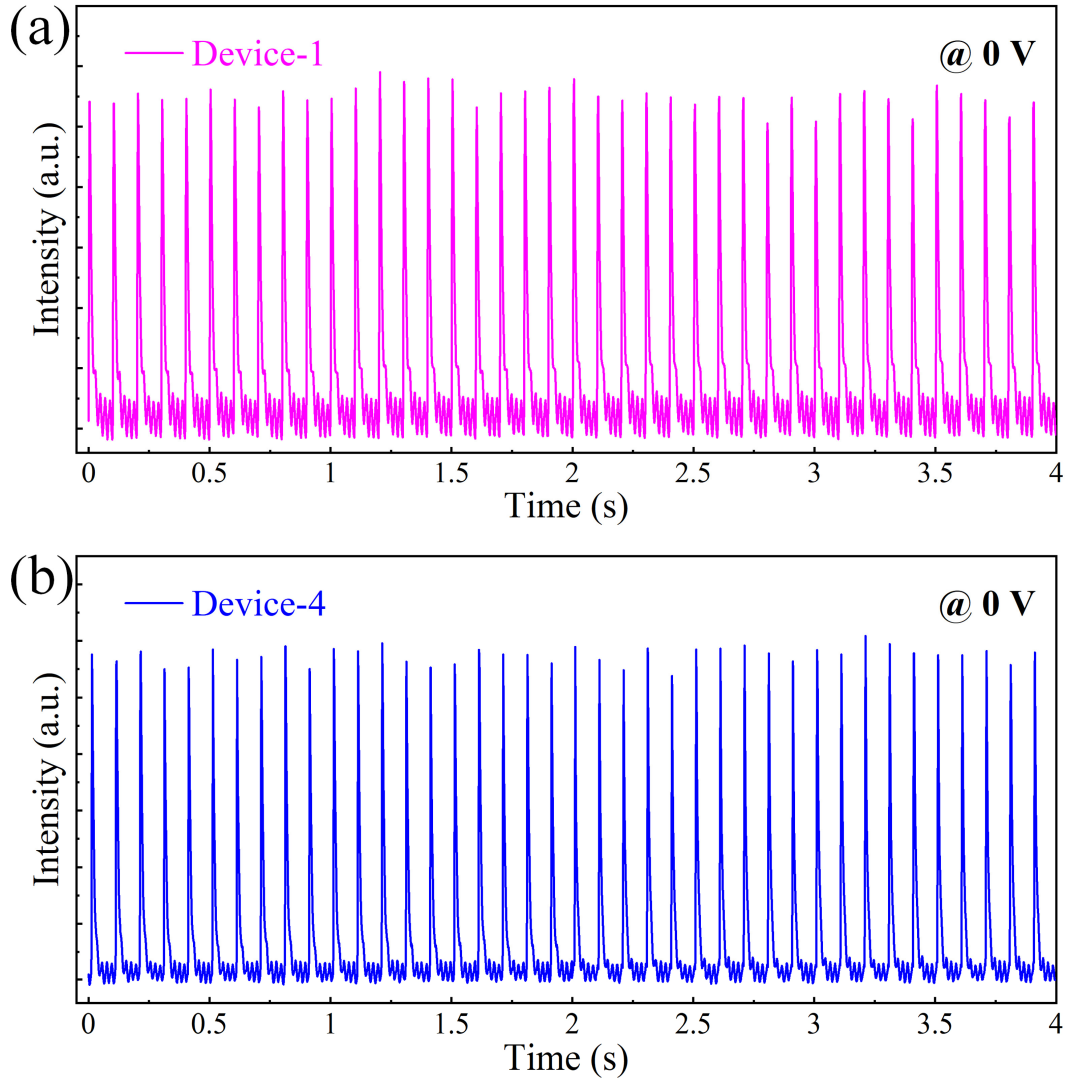


**Figure S16.** Multicycle time-resolved photoresponse curve of (a) Device-1 and (b) Device-4 upon 370 nm pulse laser illuminated.

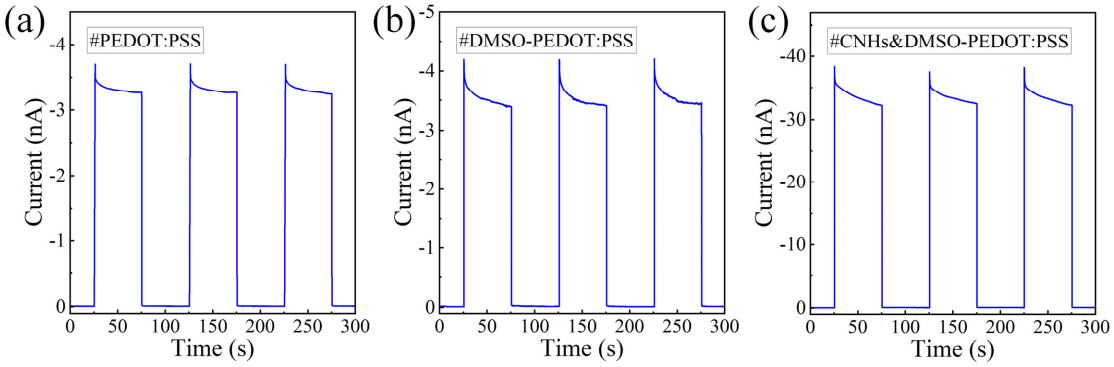


**Figure S17.** The measured photoresponses of the fabricated n-ZnO:Ga MW/p-PEDOT:PSS heterojunction photodetectors, in which the used PEDOT:PSS samples was untreated (a), treated by DMSO (b) and CNHs&DMSO (c), respectively.

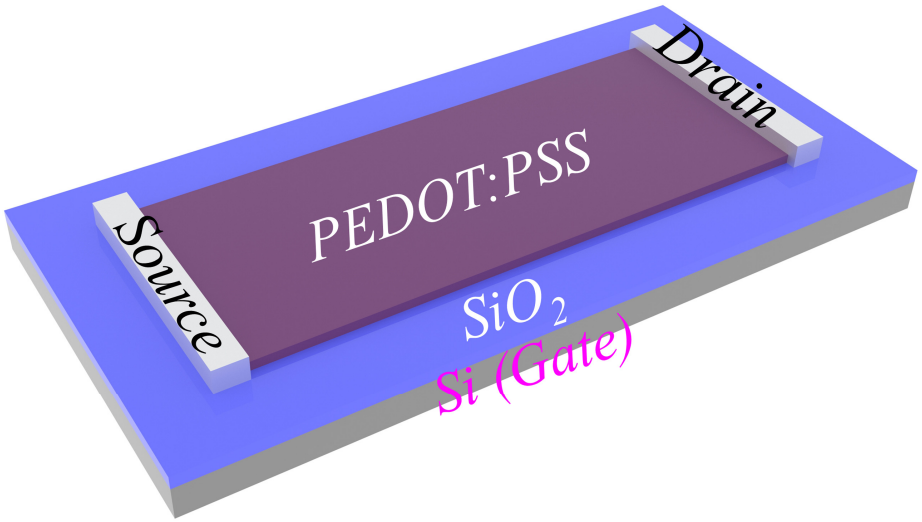


**Figure S18.** Schematic diagram of the fabricated OFET device, which is composed of a microribbon-like PEDOT:PSS film and $SiO_2$/Si substrate. In the device structure, Ag pastes are employed as the electrodes.

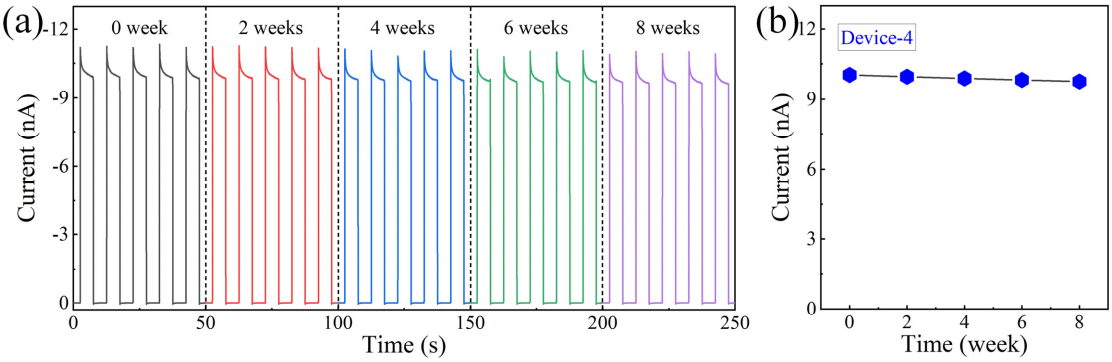


**Figure S19.** Long time stability measurement of Device-4.