Electronic Supplementary Information

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

Yang Liu, a Mingming Jiang, *a Peng Wan, a Tong Xu, a Daning Shi a and Caixia Kan *a

a College of Physics, MIIT Key Laboratory of Aerospace Information Materials and Physics, Key Laboratory for Intelligent Nano Materials and Devices, Nanjing University of Aeronautics and Astronautics, No. 29 Jiangjun Road, Nanjing 211106, P. R. China.

*E-mail: mmjiang@nuaa.edu.cn; cxkan@nuaa.edu.cn
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.

<table>
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<tr>
<th>Doping volume (μL)</th>
<th>x (mm)</th>
<th>y (mm)</th>
<th>z (μm)</th>
<th>G (S)</th>
<th>σ (S/m)</th>
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<tbody>
<tr>
<td>0</td>
<td>0.571</td>
<td>1.76</td>
<td>0.829</td>
<td>1.47×10⁻⁵</td>
<td>54.7</td>
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<tr>
<td>5</td>
<td>0.456</td>
<td>2.04</td>
<td>1.32</td>
<td>1.96×10⁻⁴</td>
<td>668.8</td>
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<tr>
<td>10</td>
<td>0.552</td>
<td>2.28</td>
<td>1.07</td>
<td>6.14×10⁻⁵</td>
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<tr>
<td>20</td>
<td>0.577</td>
<td>2.23</td>
<td>1.01</td>
<td>1.49×10⁻³</td>
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<tr>
<td>30</td>
<td>0.413</td>
<td>1.97</td>
<td>0.958</td>
<td>1.71×10⁻³</td>
<td>8497.3</td>
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<tr>
<td>40</td>
<td>0.727</td>
<td>2.59</td>
<td>1.08</td>
<td>3.16×10⁻³</td>
<td>10394.3</td>
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</tbody>
</table>

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.