Supporting Information

Structural Designs of AlGaN/GaN Nanowire-Based Photoelectrochemical Photodetectors: Carrier Transport Regulation in GaN Segment as Current Flow Hub

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Section 1: Supplementary Figures

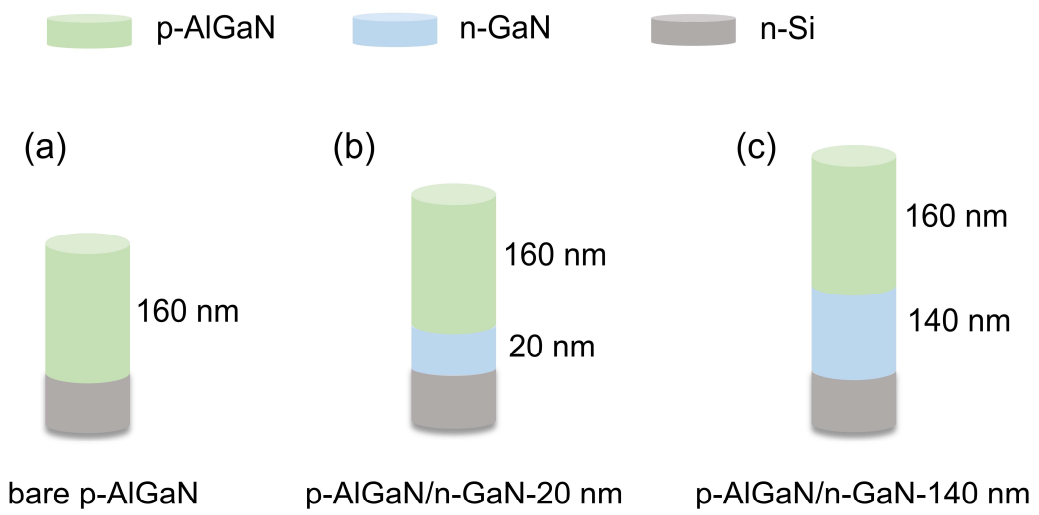

Fig. S1 The three photoelectrode structures include (a) 160 nm bare p-AlGaN, (b) 160 nm p-AlGaN/20 nm n-GaN, and (c) 160 nm p-AlGaN/140 nm n-GaN.

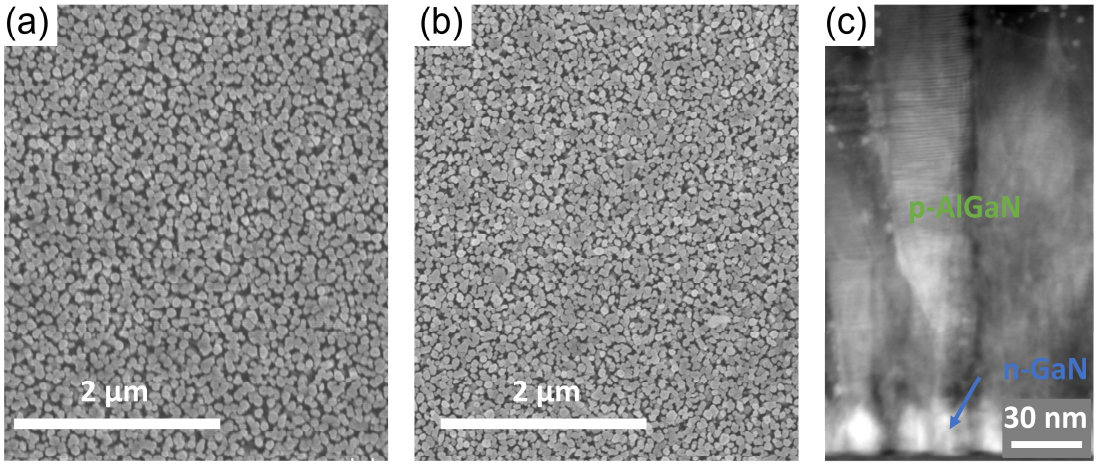

Fig. S2 (a) The bird-view SEM image of the 160 nm bare p-AlGaN NWs. (b) The top-view SEM image and (c) STEM image of the 160 nm p-AlGaN/20 nm n-GaN nanowires.

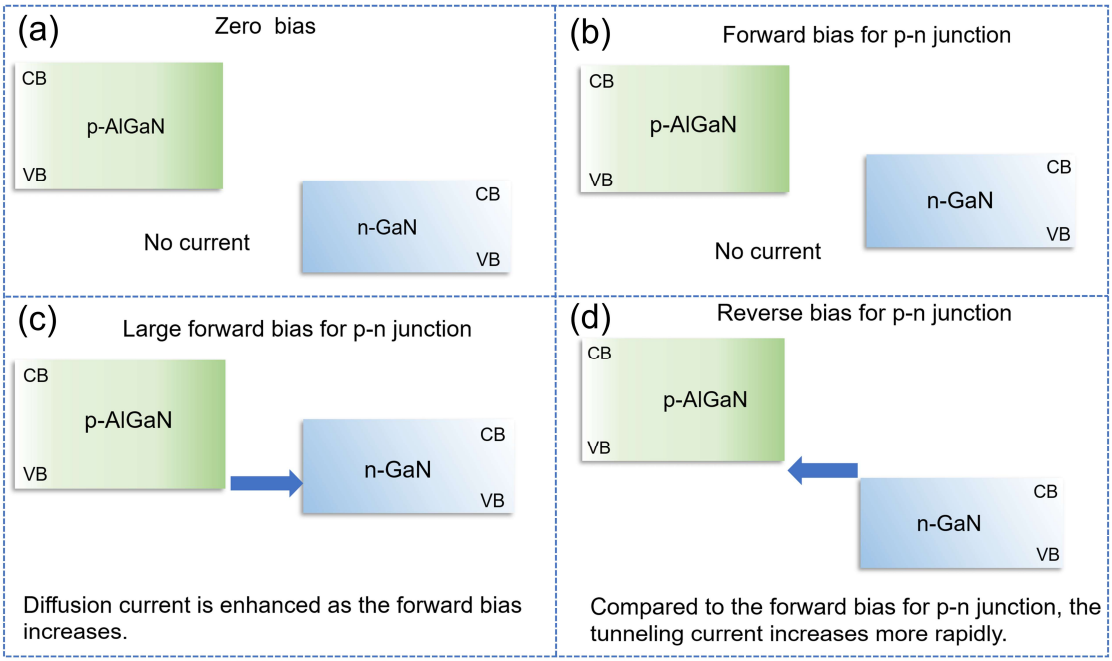

Fig. S3 Energy band diagrams of p-AlGaN/n-GaN hetero-junction under dark conditions. (a) Zero bias, (b) Forward bias, (c) Large forward bias, (d) Reverse bias for the p-n junction. The CB and VB represent the conduction band and valence band, respectively.

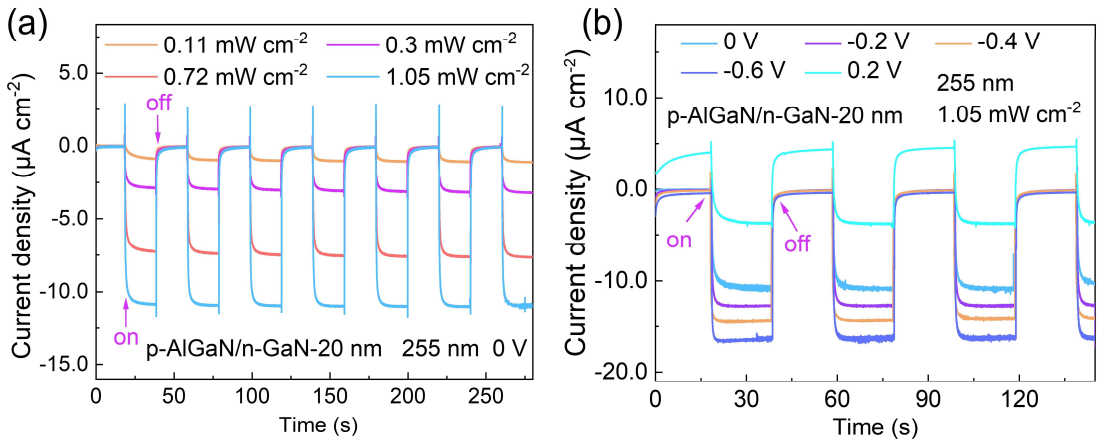

Fig. S4 Photocurrent densities of the 160 nm p-AlGaN/20 nm n-GaN sample at (a) different power intensities and (b) various applying biases at 255 nm light.

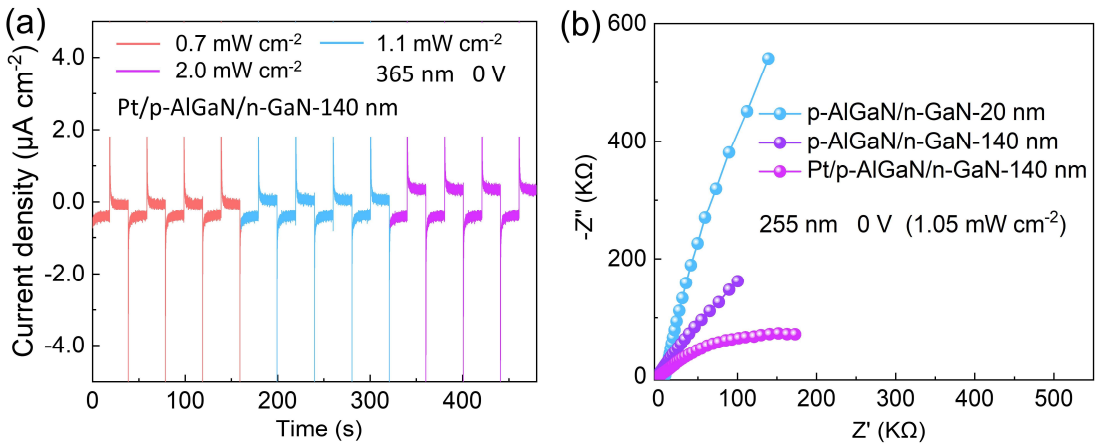

Fig. S5 (a) Photocurrent densities of the PEC PD with Pt/160 nm p-AlGaN/140 nm n-GaN NWs under 365 nm with different light intensities (0 V). (b) Comparison of the EIS curves at 255 nm light in these constructed PEC devices.

Section 2: Supplementary Notes

It can be seen that the steady-state photocurrent under 365 nm illumination is smaller compared with that of 255 nm light, which may be because only the GaN part responds to the 365 nm light. In addition, the contact area between the bottom GaN and electrolyte is constrained because most of the GaN area was covered by the AlGaN layer. And the small effective light-absorbing area and a long optical path where the light propagates along the nanowires would prevent the generation of carriers, thus causing a small positive photocurrent density when illuminated at 365 nm light.