Supplementary Information

Optimizing Performance of Silicon-Based pn Junction Photodetector by Piezo-Phototronic Effect

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I-strain characteristics and detectivity *D** of the p-Si/n-ZnO NWs hybridized photodetector

I-strain characteristics of p-Si/n-ZnO NWs hybridized visible PDs under a series of incident light power densities and external strain conditions are investigated and summarized in Figure S1a under 442 nm illuminations and 2 V forward bias voltage. The response of output currents to different strains show a monotonous increase with externally applied strains for each power density. Also, the overall signal levels increase significantly by applying light stimuli with stronger power density, because more photon-induced electron-hole pairs are generated.

As shown in Figure S1b, the detectivity *D** is calculated under different incident light intensities and strain conditions as $D^*=R/(2e\cdot I_{dark,s}/S)^{0.5}$, where $I_{dark,s}$ is the dark current under the corresponding external strain (considered as the major noise), *S* is the effective surface area of PD[1]. Experimental results indicate that a maximum value is observed at -0.1‰ compressive strain for the detectivity *D** under each

illumination power density, with the highest value of 7.1×10^{9} Jones under the power density of 3.2×10^{-5} W/cm^2.

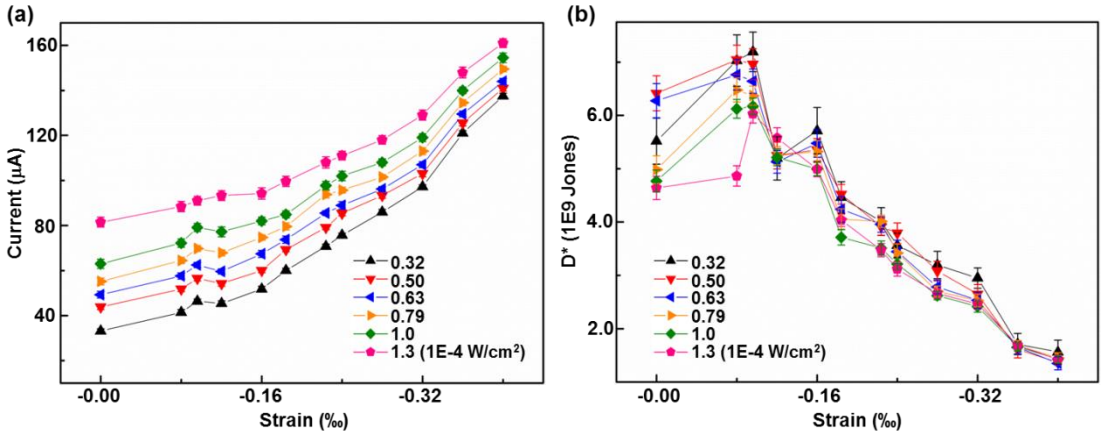

Figure S1. Piezo-phototronic effect on (a) the output current and (b) the detectivity *D** of p-Si/n-ZnO NWs hybridized PDs under a series of power densities and external strain conditions.

1. Liu, X.; Gu, L. L.; Zhang, Q. P.; Wu, J. Y.; Long, Y. Z.; Fan, Z. Y. All-Printable Band-Edge Modulated ZnO Nanowire Photodetectors with Ultra-High Detectivity. *Nat Commun* 2014, 5, 4007.