Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

A Self-powered Broadband Photodetector Based on n-Si(111)/p-NiO Heterojunction with High Photosensitivity and Enhanced External Quantum Efficiency

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Part I: Supplementary Figures

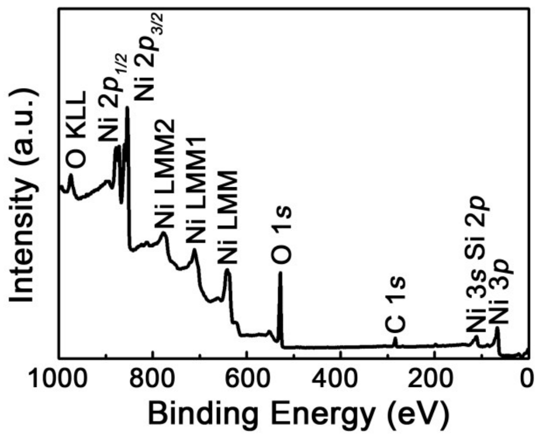

Figure S1. X-ray photoelectron spectroscopy of a full survey of the n-Si(111)/p-NiO heterojunctions.

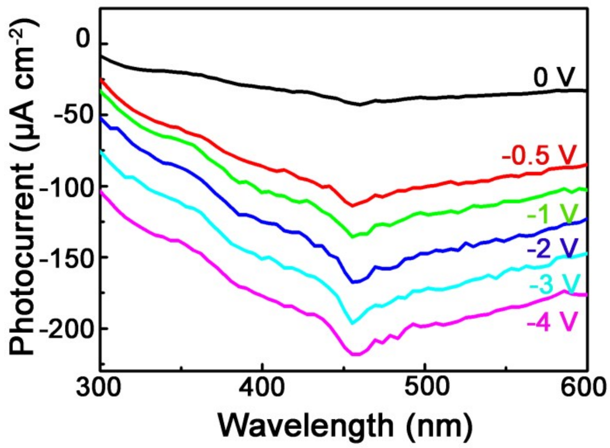

Figure S2. Photocurrent spectra of the n-Si(111)/p-NiO heterojunction photodetector with an applied bias of 0 V (black), -0.2 V (red), -1 V (green), -2 V (navy blue), -3 V (light blue) and -4 V (pink), respectively.

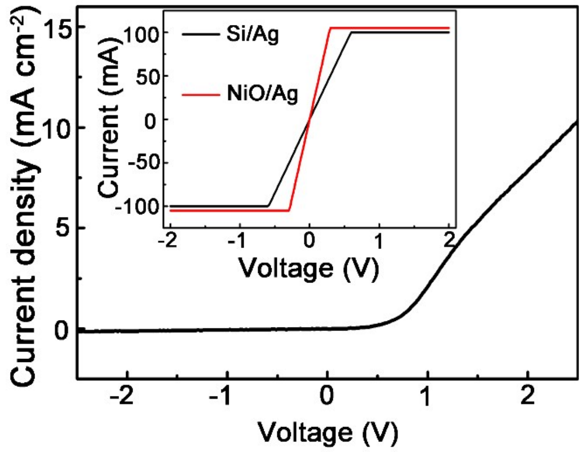

Figure S3. The J-V curves of the device with the n-Si(111)/p-NiO heterojunctions upon a bias from -2 V to 2V under dark. The inset shows the I-V contact characteristics of the n-Si/Ag and p-NiO/Ag, respectively.

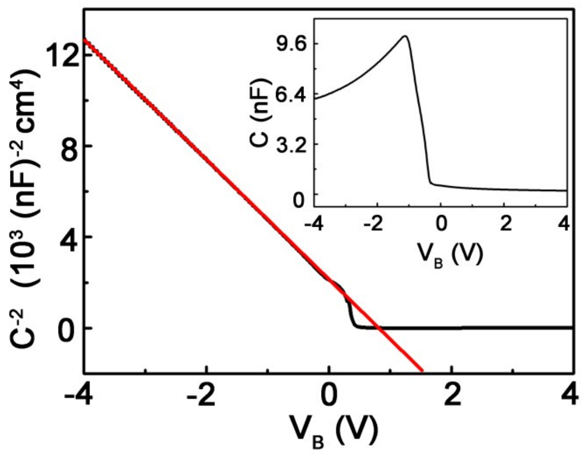

Figure S4. C^{-2} versus V_B plot of the n-Si(111)/p-NiO heterojunctions and a line (red line) for its fitting, and the intersection of fitting line at the voltage axis (V_{bi}). Insert was the original date C versus V_B.

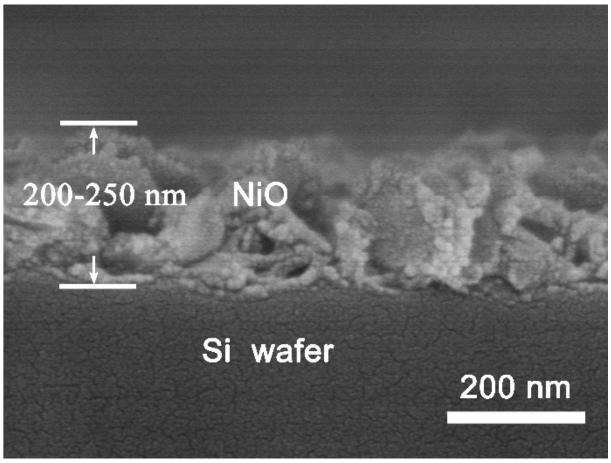

Figure S5. The cross-sectional SEM image of the n-Si(111)/p-NiO heterojunctions.

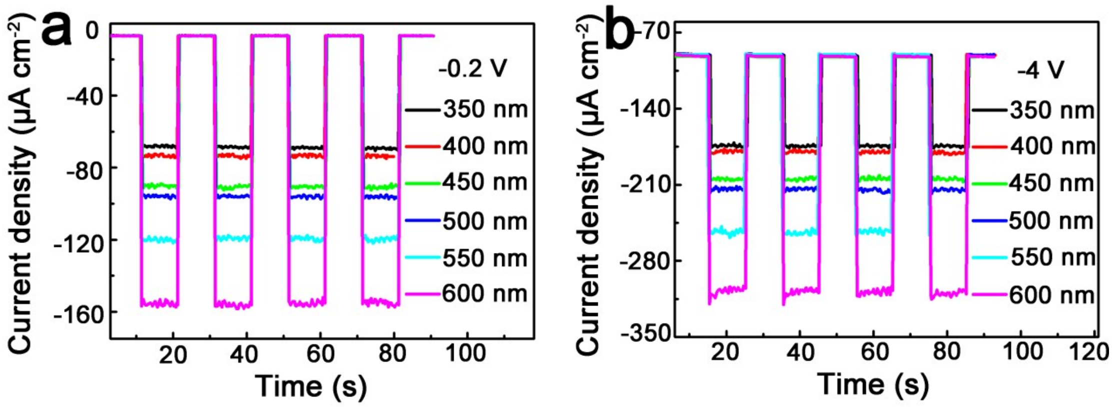

Figure S6. Photocurrent responses of the n-Si(111)/p-NiO heterojunction photodetector under on/off light illumination with a density of 0.5 mW cm^{-2} in a period of 10 s at a bias of -0.2 V (a) and -4 V (b).

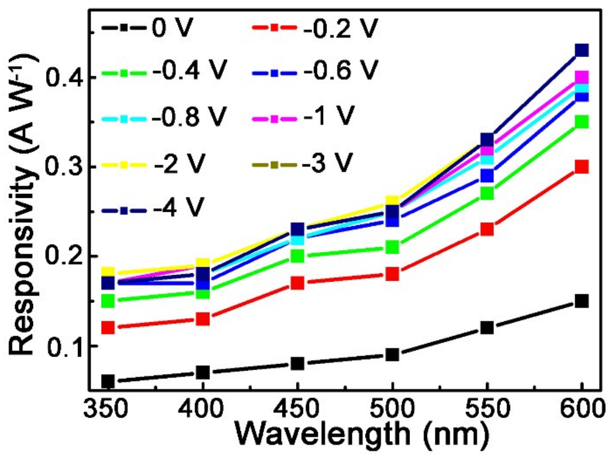

Figure S7. Spectral responsivity curves obtained in the range of 350-600 nm under a reverse bias of 0V, -0.2V, -0.4V, -0.6V, -0.8V, -1V, -2V, -3V and -4V, respectively.

Part II: Calculations

The width of the depletion layer (X_D), which changed with the added reverse bias V, was estimated from Poisson Equation as follows[1]:

$$X_D = [\frac{2\varepsilon_{N_iO}\varepsilon_{S_i}\left(N_{N_iO} + N_{S_i}\right)^2 (V_{bi} - V)}{qN_{N_iO}N_{S_i}(\varepsilon_{N_iO}N_{N_iO} + \varepsilon_{S_i}N_{S_i})}]^{1/2}$$

Where V_{bi} is the buil-in voltage caused by the internal electrical field at zero bias and V was the external voltage applied.

References:

[1] S. M. Sze, *Physics of Semiconductor Devices*, 2nd ed. (Wiley, New York, 1981).