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

Supporting Information

An efficiently enhanced UV-visible light photodetector with a Zn: NiO/p-Si isotype heterojunction

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Supplementary Figures

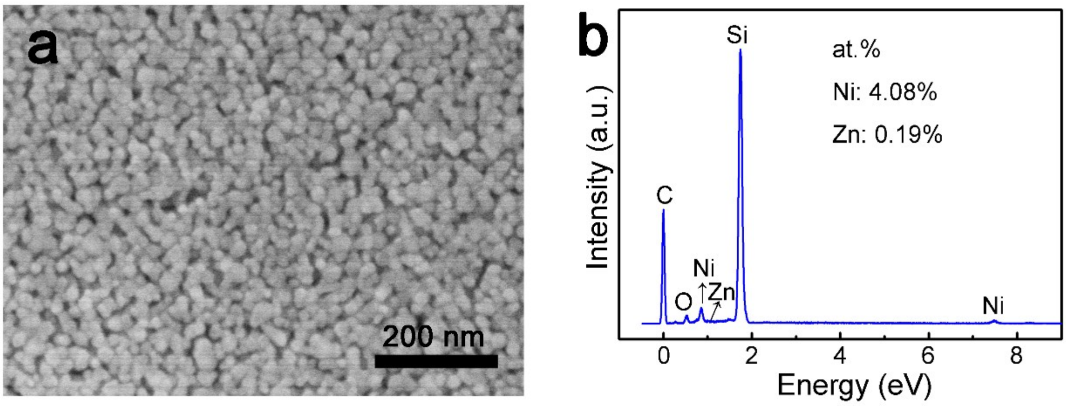

Figure S1. (a) SEM image of the NiO films without Zn doping. (b) EDX pattern taken from the Zn:NiO films.

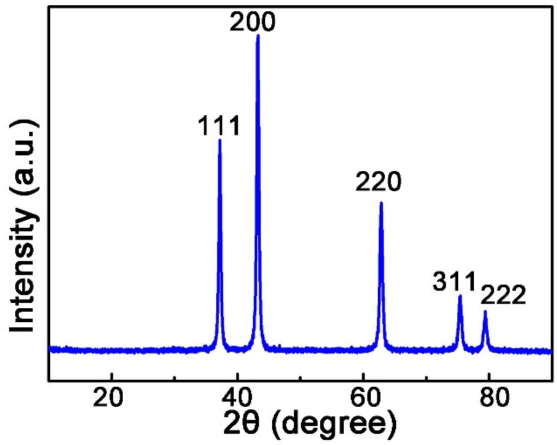

Figure S2. XRD patterns of the NiO films without Zn doping.

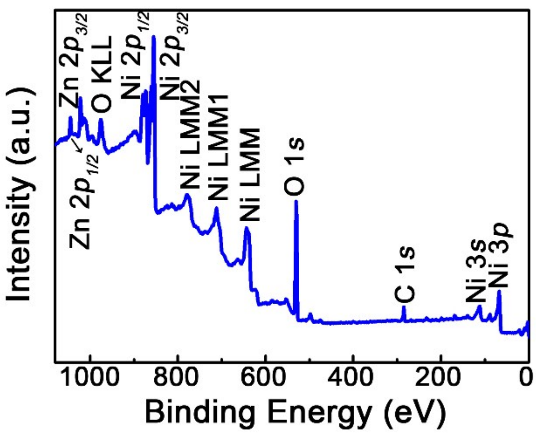

Figure S3. X-ray photoelectron spectroscopy of a full survey of the Zn:NiO/p-Si heterojunction.

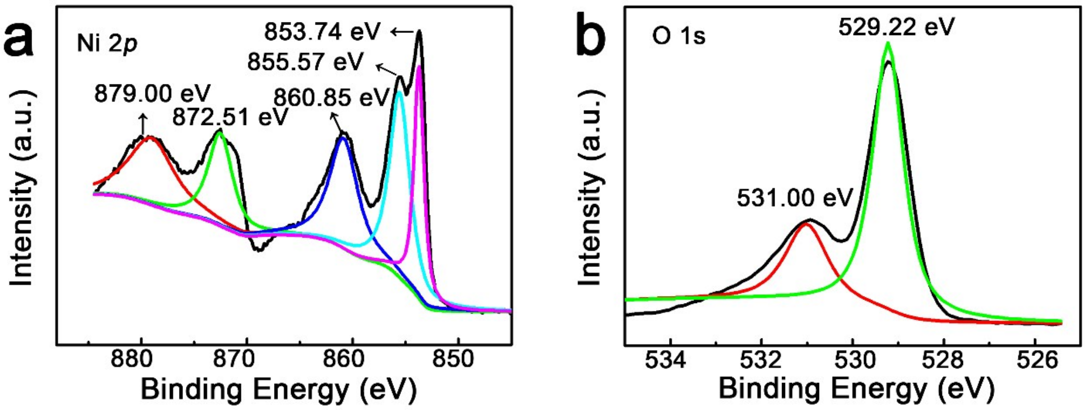

Figure S4. XPS spectra of the undoped NiO/p-Si heterojunction. High resolution XPS spectra for Ni (a) and O (b), respectively.

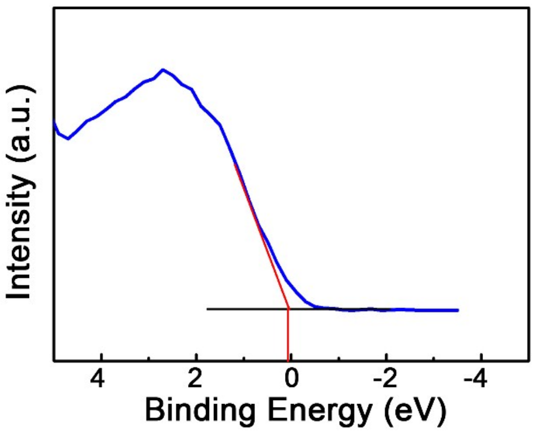

Figure S5. The valence band maximum of the cleaned Si substrate by analysing the XPS spectrum.

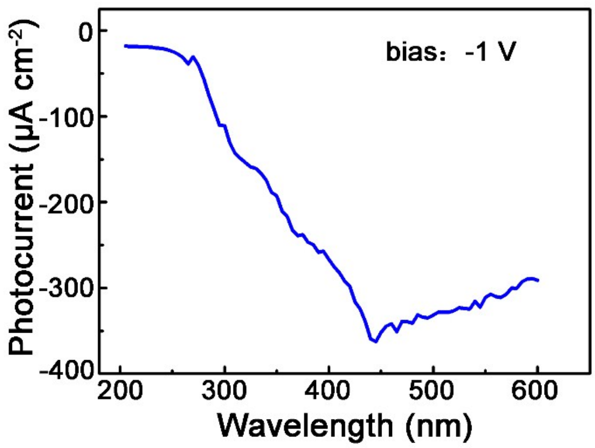

Figure S6. A photocurrent spectrum of the NiO/p-Si heterojunction photodetector with an applied bias of -1 V.

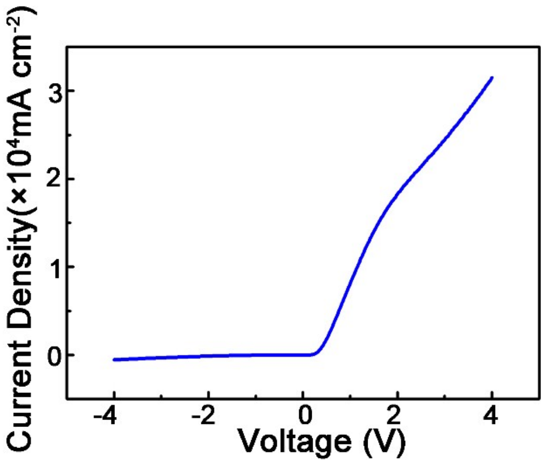

Figure S7. The J-V curve of the Zn:NiO/p-Si heterojunction device upon a bias from -4 V to 4V under dark.

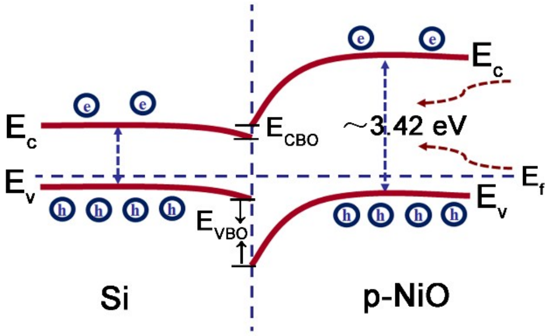

Figure S8. Band diagrams of the undoped NiO/p-Si heterojunction at the interface under a reverse bias.

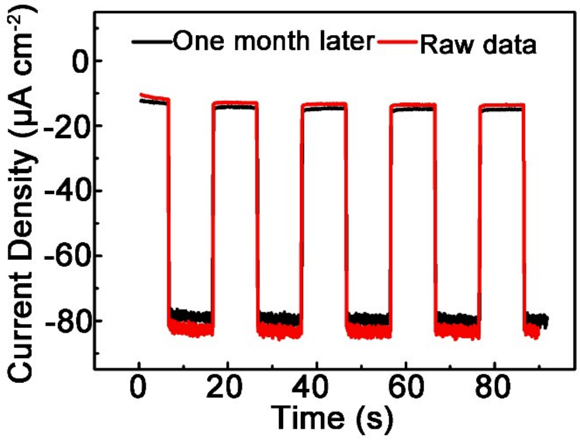

Figure S9. Photocurrent responses of the Zn:NiO/p-Si heterojunction photodetector at -1 V under 450 nm light illumination recorded before (raw data) and after one month.

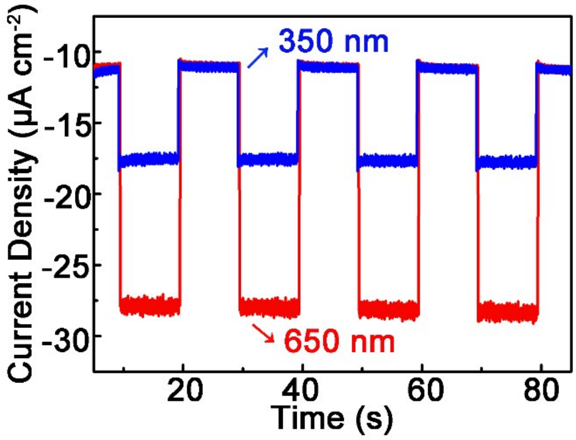

Figure S10. Photocurrent responses of the undoped NiO/p-Si heterojunction photodetector at -1 V with a light density of 0.5 mW cm^{-2} under 350 nm and 650 nm light illumination, respectively.

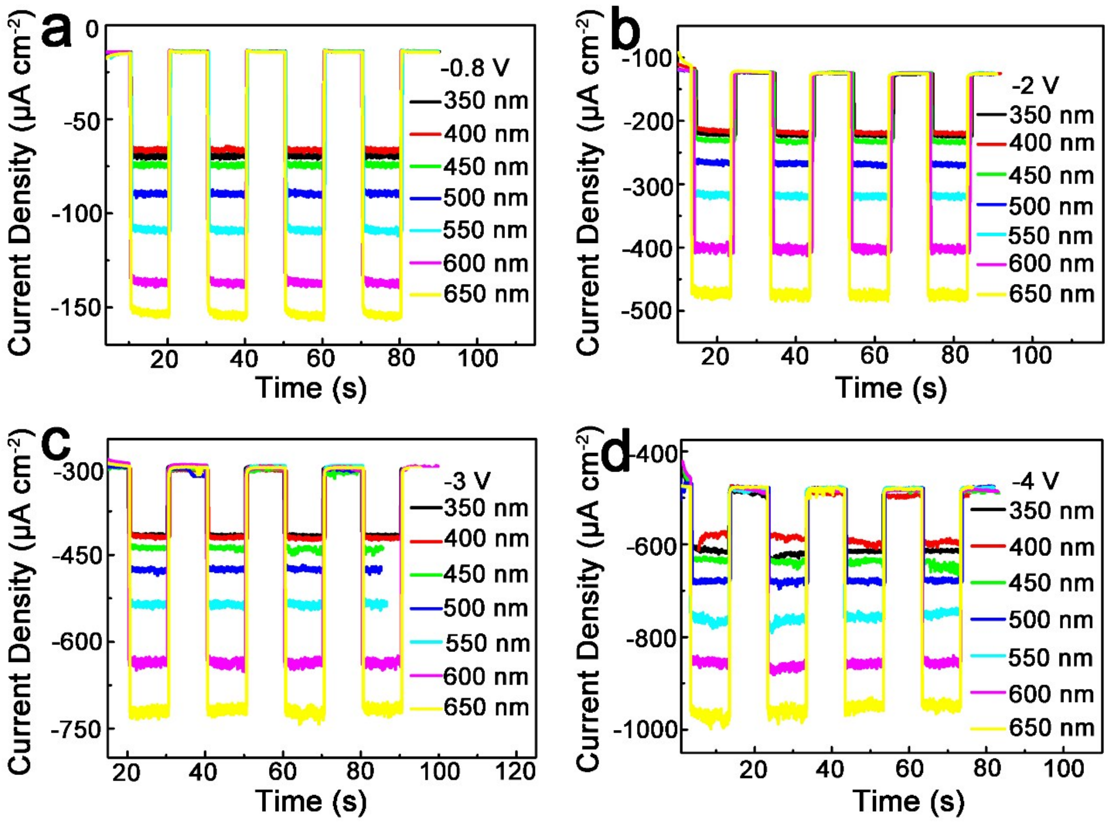

Figure S11. Photocurrent responses of the Zn-doped NiO/p-Si heterojunction photodetector under on/off light illumination at various applied voltage with a light density of 0.5 mW cm^{-2}.

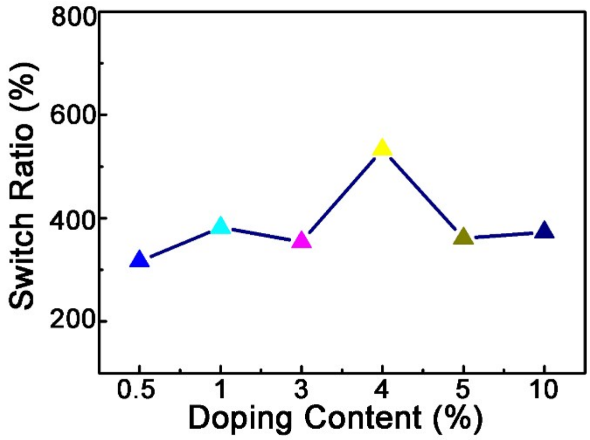

Figure S12. Switch ratio of the Zn:NiO/p-Si heterojunction photodiode with various Zn-doping content at an applied voltage of -1 V under 450 nm light illumination (0.5 mW cm^{-2}).

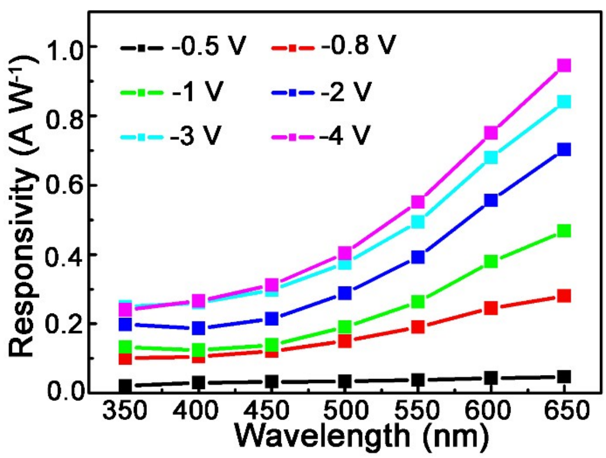

Figure S13. Spectral responsivity curves of the Zn-doped NiO/p-Si heterojunction photodetector in the range of 350-650 nm under a reverse bias of -0.5 V, -0.8 V, -1 V, -2 V, -3 V and -4 V, respectively.

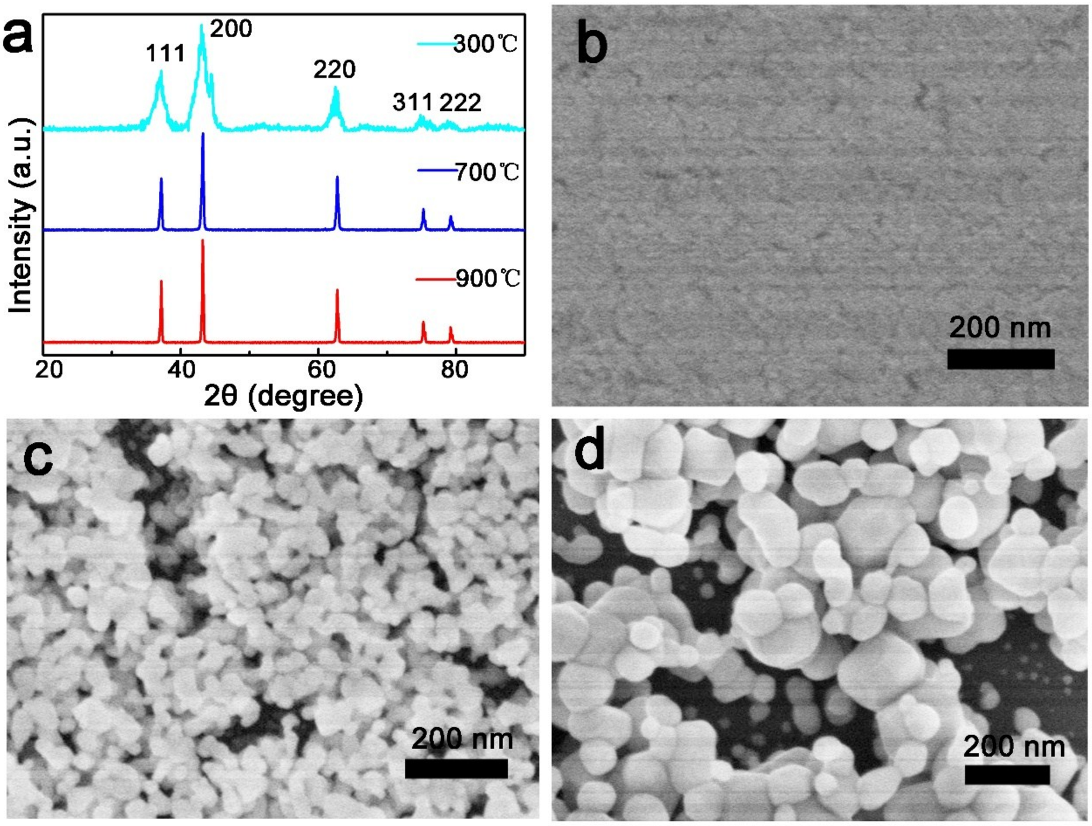

Figure S14. XRD patterns (a) of the NiO thin film sample annealed at 300 °C, 700 °C and 900 °C, respectively. SEM images showing the surface views of the NiO thin film on the Si substrates annealed at 300 °C (b), 700 °C (c) and 900 °C (d), respectively.

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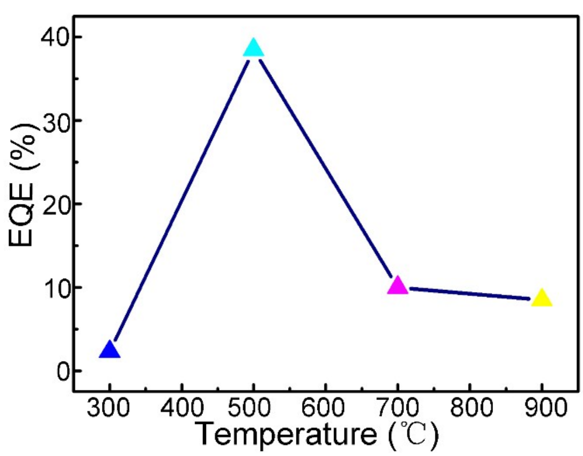

Figure S15. EQE of the Zn:NiO/p-Si heterojunction photodiode annealed at 300 ℃, 500 ℃, 700 ℃ and 900 ℃, respectively, with an applied voltage of -1 V under 450 nm light illumination.

Supplementary Table

Table S1. The measurement parameter values obtained by Hall measurement with the Zn-doped and undoped NiO films.

Input value	I (nA)	B	D	D_T	MN	T (K)
	1.000	0.560	0.200	0.100	1000	300

Result	**Undoped**	**Zn-doped**
Bulk concentration	8.459×10^{15}	2.906×10^{12}
Mobility	1.850×10^{1}	5.730×10^{1}
Resistivity	3.989×10^{1}	3.748×10^{4}
Average Hall Coefficient	7.379×10^{2}	2.148×10^{6}
AC Cross Hall Coefficient	6.593×10^{2}	3.651×10^{5}
BD Cross Hall Coefficient	8.165×10^{2}	4.661×10^{6}
Sheet Concentration	1.692×10^{11}	5.812×10^{7}
Conductivity	2.507×10^{-2}	2.668×10^{-5}
Magneto-Resistance	1.341×10^{5}	3.197×10^{8}