Electronic Supplementary Material

A novel silver-doped nickel oxide hole-selective contact for crystalline silicon heterojunction solar cells

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1. Supplemental Figures

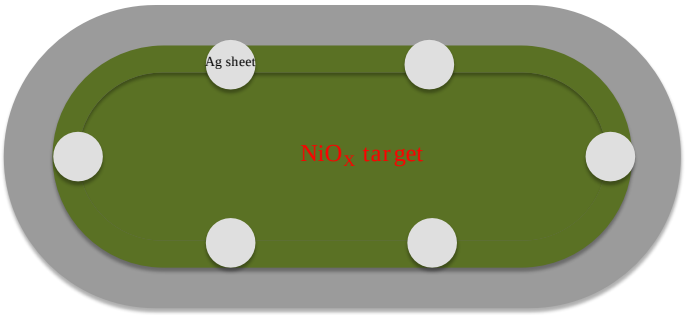

Fig. S1. Schematic diagram of the SMD method.

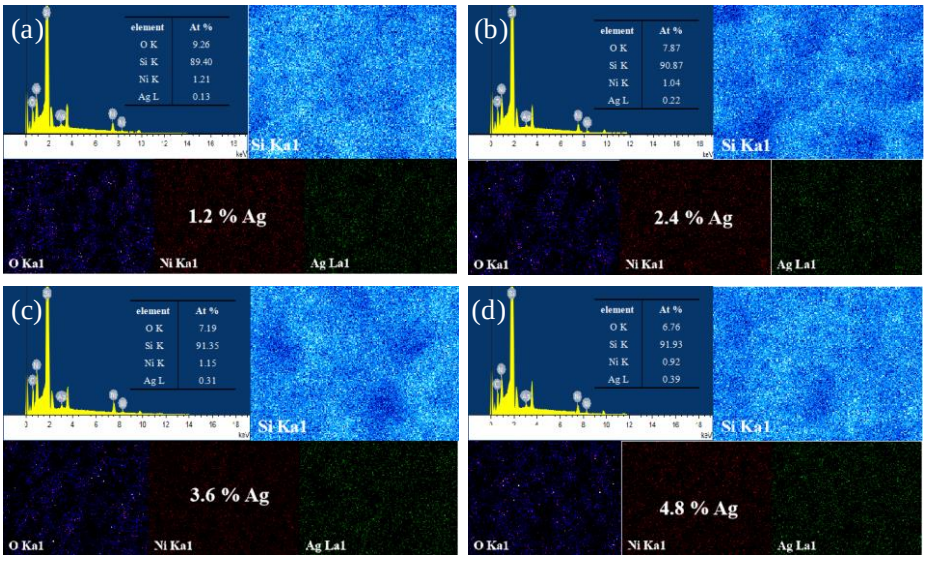

Fig.S2. The EDS spectra and elemental mapping images of different silver-doped NiO_x films.

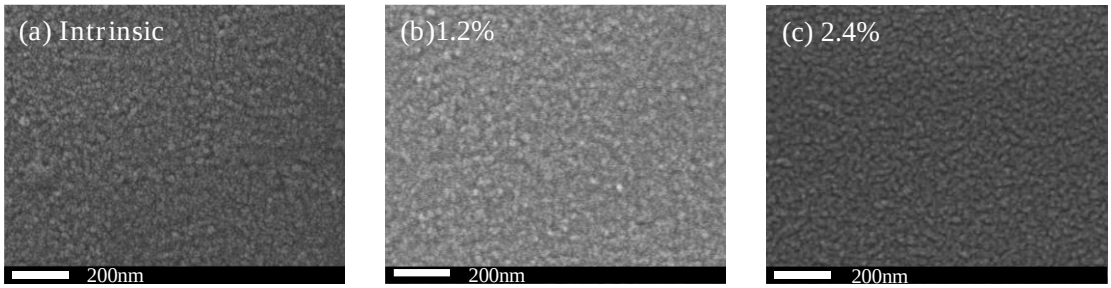

Fig. S3. SEM plots of NiO_x films with different Ag contents: (a) 0; (b) 1.2%; (c) 2.4%.

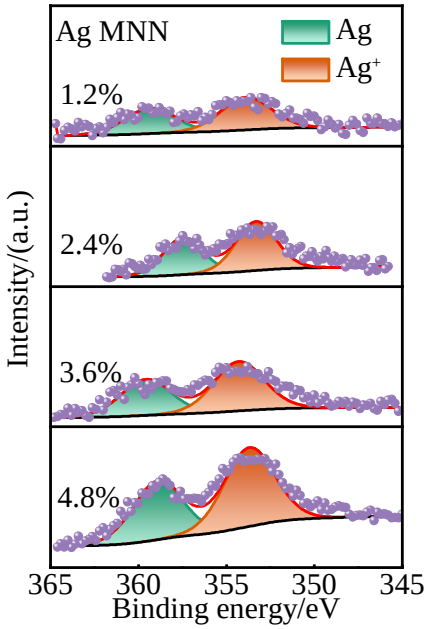

Fig. S4. Ag MNN Auger spectroscopy of NiO_x films with different Ag doping levels.

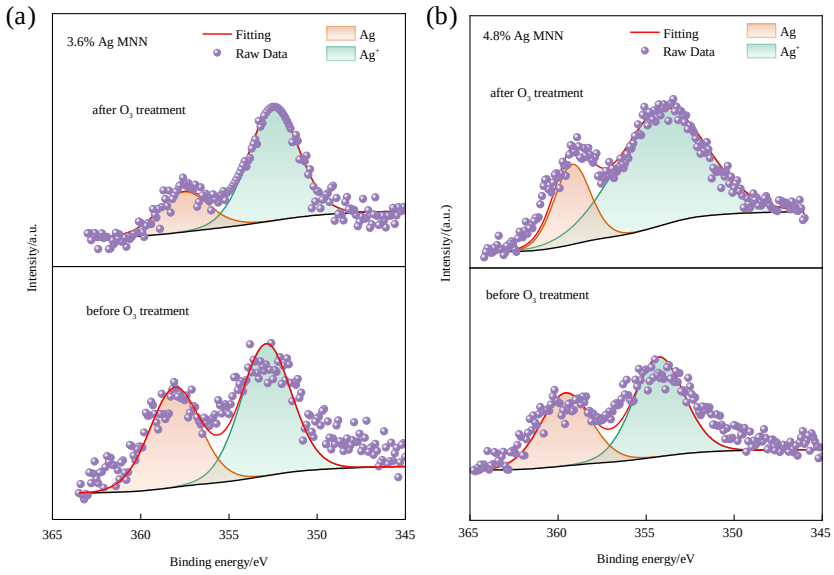

Fig. S5. MNN Auger spectroscopy of NiO_x thin films with different Ag doping before and after ozone treatment: (a) 3.6%, (b) 4.8%.

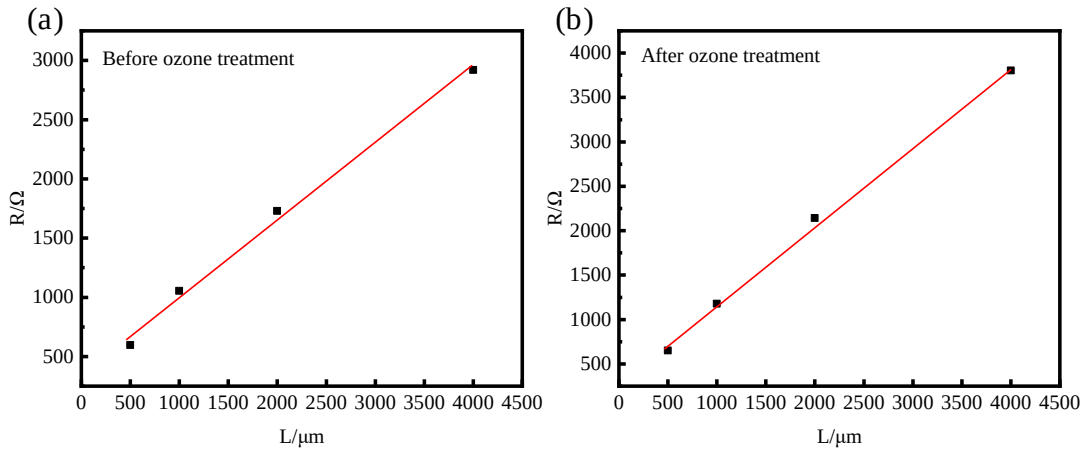

Fig. S6. Plot of resistance variation with electrode distance before and after ozone treatment.

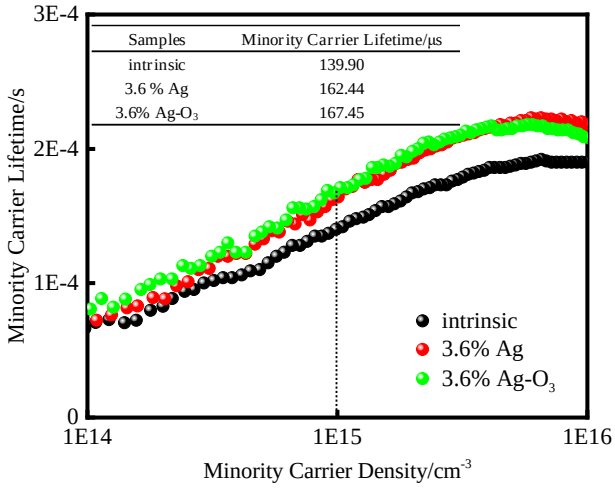

Fig. S7. Minority carrier lifetimes of different c-Si(n)/NiO_x structures.

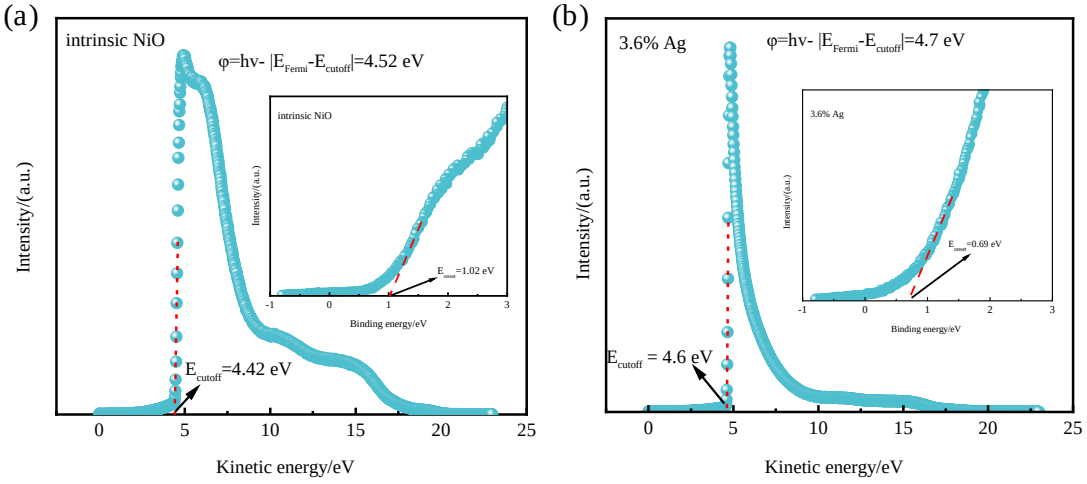

Fig. S8. (a) Intrinsic NiO_X; (b) UPS full spectrum and valence band spectrum of NiO_X film doped with 3.6% Ag.

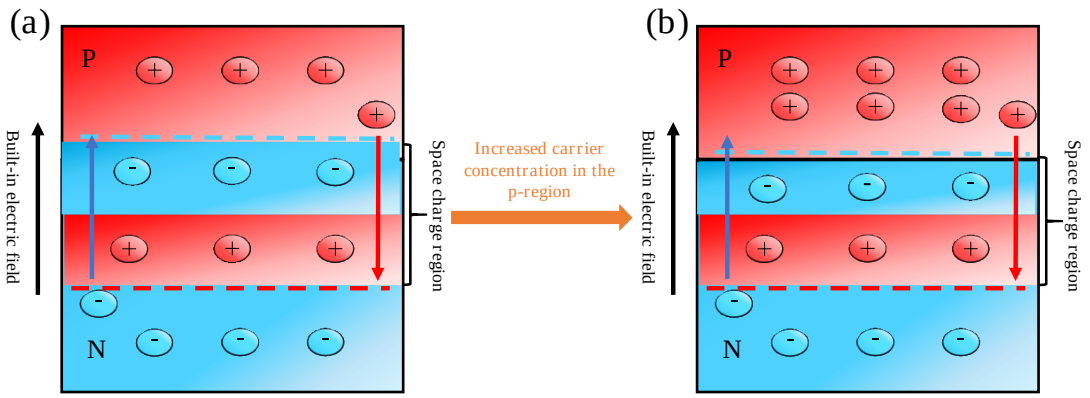

Fig. S9. Plot of depletion layer width before and after increasing carrier concentration in the p-region.

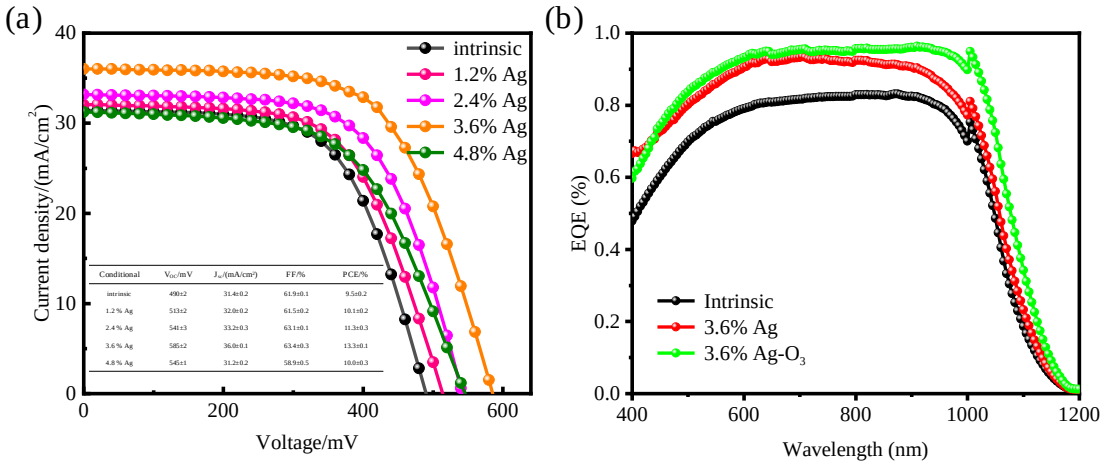

Fig. S10. (a) J-V plots of solar devices under different silver doping conditions. (b) EQE curves of solar cells under different silver doping conditions.

2. Supplementary tables

Table S1 EDS plots of NiO_x samples with different silver contents.

Samples	O K (Percentage of atoms)	Ni K (Percentage of atoms)	Ag L (Percentage of atoms)	Si K (Percentage of atoms)	Ag/(Ag+Ni+O)
0	7.48	1.34	0	91.18	0
1.2 %	9.26	1.21	0.13	89.40	0.0122
2.4 %	7.87	1.04	0.22	90.87	0.0241
3.6 %	7.19	1.15	0.31	91.35	0.0358
4.8 %	6.76	0.92	0.39	91.93	0.0483

Table S2 Performance of devices with different Ag^+ doping before and after UV/O_3 treatment.

Conditional	V_{OC}/mV	J_{sc}/(mA/cm²)	FF/%	PCE/%
No Ag	490±2	31.4±0.2	61.9±0.1	9.5±0.2
No Ag-UV/O_3	493±2	31.7±0.1	62.1±0.5	9.7±0.3
1.2 % Ag	513±2	32.0±0.2	61.5±0.2	10.1±0.2
1.2 % Ag-UV/O_3	531±3	32.6±0.2	62.5±0.3	10.8±0.3
2.4 % Ag	541±3	33.2±0.3	63.1±0.1	11.3±0.3
2.4 % Ag-UV/O_3	549±5	35.7±0.3	61.5±0.2	12.0±0.3
3.6 % Ag	585±2	36.0±0.1	63.4±0.3	13.3±0.1
3.6 % Ag-UV/O_3	596±2	38.4±0.4	63.0±0.1	14.4±0.2
4.8 % Ag	545±1	31.2±0.2	58.9±0.5	10.0±0.3
4.8 % Ag-UV/O_3	550±2	29.4±0.3	58.4±0.2	9.4±0.2