

Supporting Information

Efficient and stable perovskite solar cells using manganese-doped nickel oxide as the hole transport layer

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Table S1. Lifetime parameters of TR-PL decay curves of the perovskite on the FTO substrate, pristine or Mn-doped NiO_x films with different doping concentration of 0.5–2 mol%.

Substrate	A ₁ (%)	τ ₁ (ns)	A ₂ (%)	τ ₂ (ns)	τ _{avg} (ns)
FTO	50.69	16.0742	49.31	103.017	90.9995
Pristine NiO _x	57.48	10.2197	42.52	62.2092	52.7601
0.5 mol% Mn-doped NiO _x	56.75	9.281	43.25	40.40	33.1997
1 mol% Mn-doped NiO _x	59.69	9.3006	40.31	46.26	37.7809
2 mol% Mn-doped NiO _x	61.95	9.29854	38.05	61.7108	51.3829

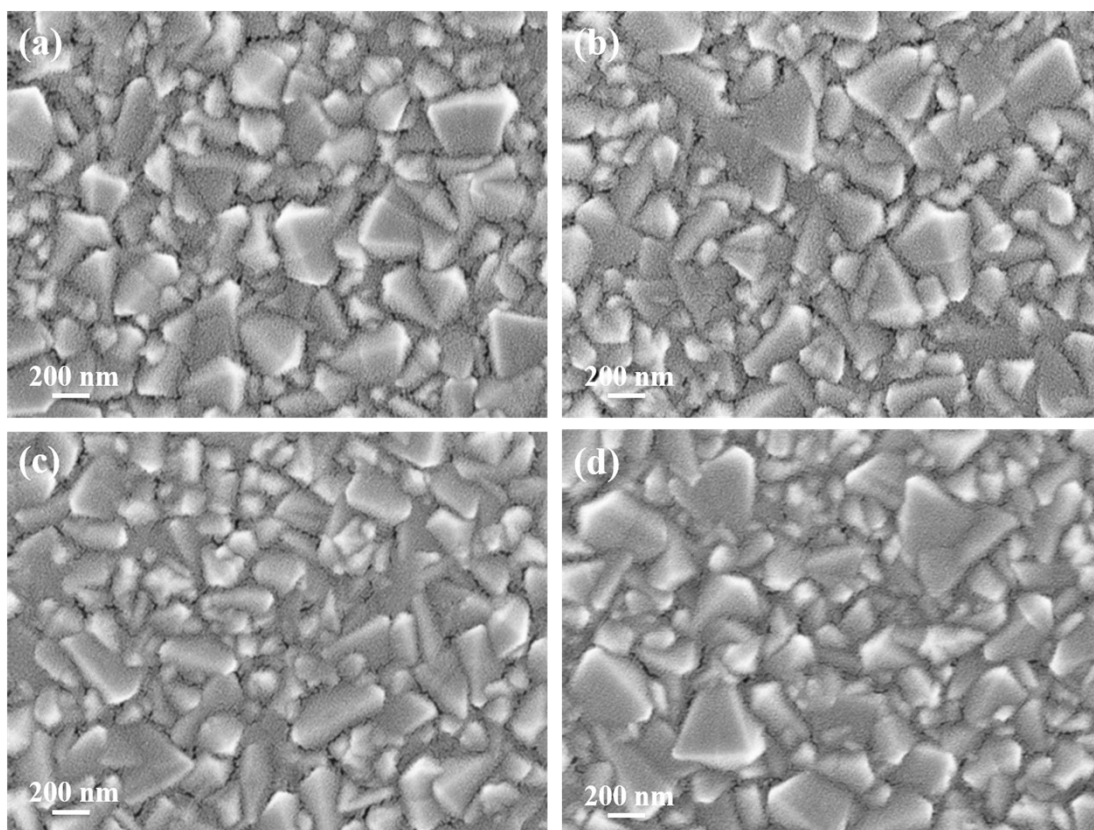


Figure S1. Top-view SEM images of the pristine and Mn-doped NiO_x films with different doping concentration of (a) 0, (b) 0.5, (c) 1, and (d) 2 mol%.

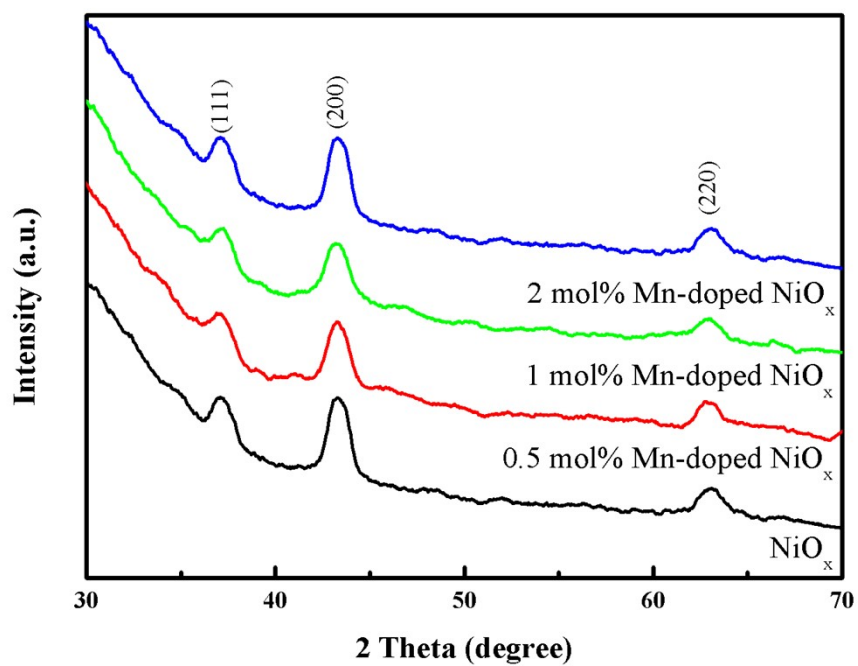


Figure S2. XRD patterns of the pristine and Mn-doped NiO_x films with different doping concentration of 0.5–2 mol%.

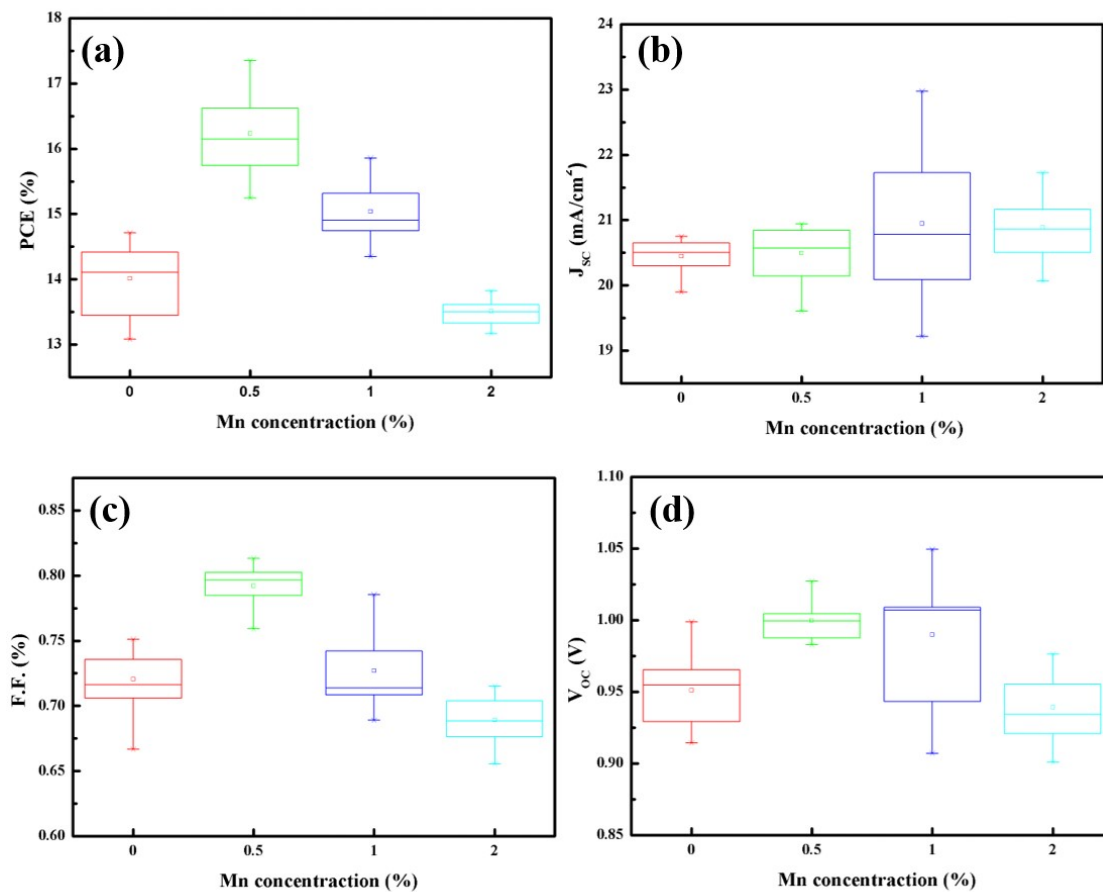


Figure S3. Performance variation represented as a standard box plot in (a) *PCE*, (b) *J_{sc}*, (c) *FF*, and (d) *V_{oc}* from 20 devices based on the pristine and Mn-doped NiO_x films with different doping concentration of 0.5–2 mol%.