

Supporting Information

Low-temperature solution-processed NiO_x film for air-stable perovskite solar cells

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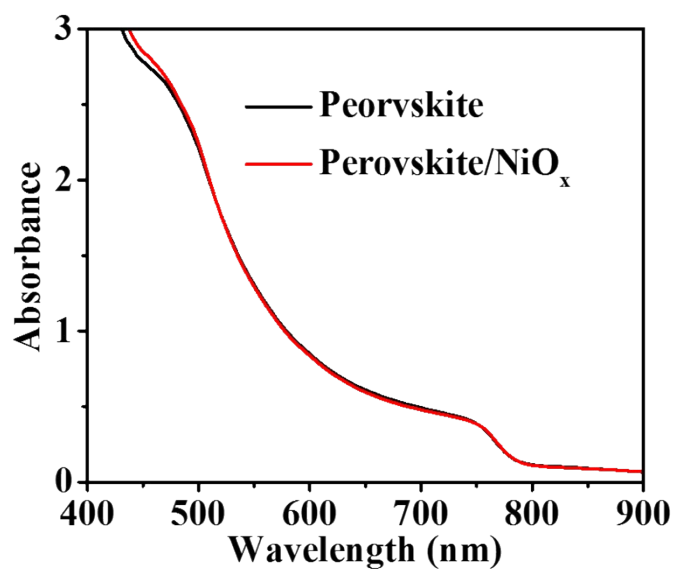


Figure S1. The absorption spectra of the perovskite film and the NiO_x film on the perovskite film.

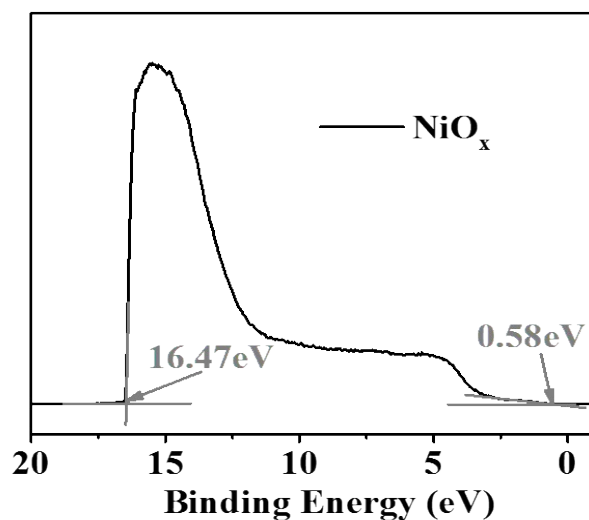


Figure S2. UPS spectrum of the NiO_x film. According to the spectrum, the work function and the valence band maximum (VBM) of the NiO_x can be determined as -4.75 eV and -5.33 eV, respectively. The position of the conduction band minimum can be determined according to the previously measured bandgap of NiO_x.^[1, 2]

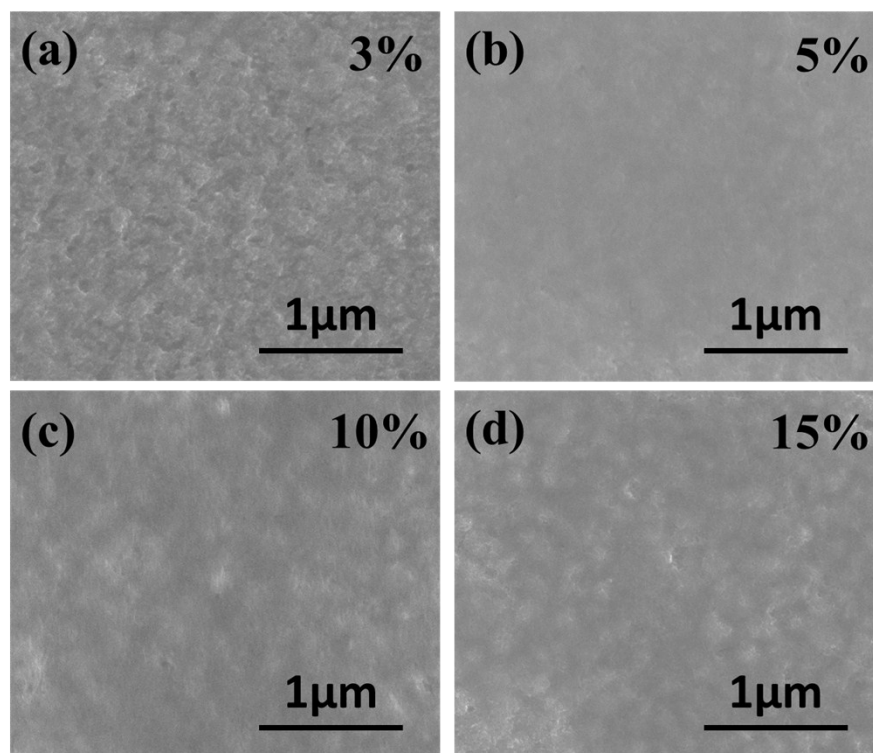


Figure S3. NiO_x film with different weight concentration of NiO_x NP suspension

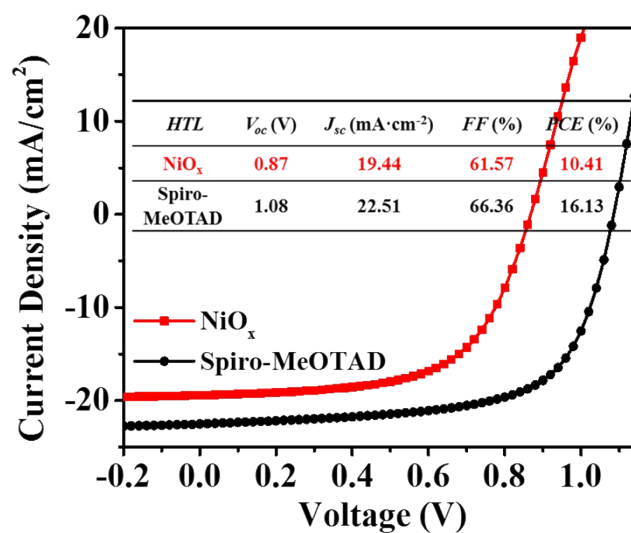


Figure S4. J-V curves and performance parameters of the PSCs with NiO_x and spiro-MeOTAD as HTL.

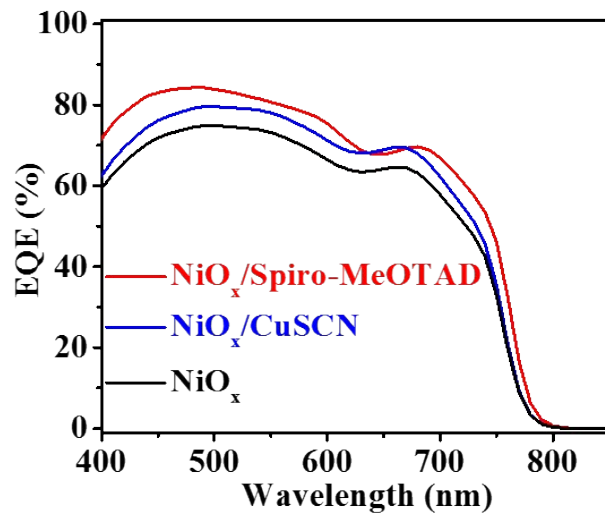


Figure S5. The external quantum efficiency (EQE) spectra of PSCs with different HTLs.

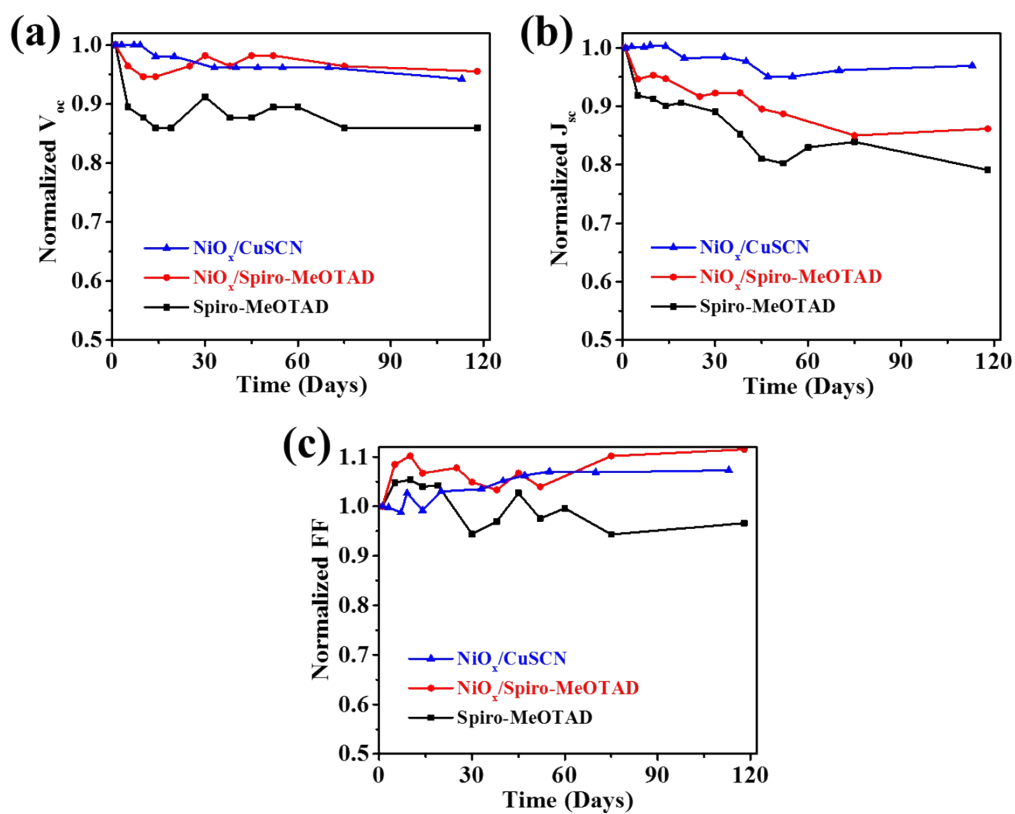


Figure S6. Air-stability of the whole device with different HTLs without encapsulation: (a) normalized V_{oc} , (b) normalized J_{sc} and (c) normalized FF.

Table S1. The conductivity of different HTLs

<i>HTL</i>	<i>Conductivity (S/cm)</i>
NiO_x Only	7.31×10^{-8}
NiO_x/CuSCN	1.26×10^{-5}
NiO_x/Spiro-MeOTAD	2.93×10^{-4}

NiO_x/CuSCN
Perovskite
TiO₂
FTO

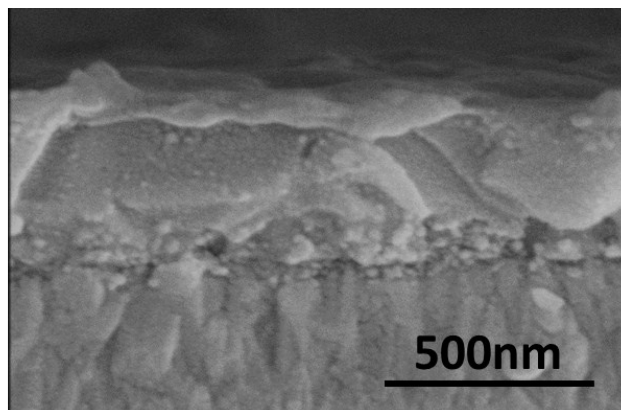


Figure S7. SEM image of the cross-section of FTO/TiO₂/Perovskite/NiO_x/CuSCN structure.

References

- [1] H. Zhang, J. Cheng, F. Lin, H. He, J. Mao, K. S. Wong, A. K. -Y. Jen and W. C. H. Choy, *ACS Nano*, 2016, **10**, 1503–1511.
- [2] S. Seo, I. J. Park, M. Kim, S. Lee, C. Bae, H. S. Jung, N. -G. Park, J. Y. Kim and H. Shin, *Nanoscale*, 2016, **8**, 11403-11412.