

Tin Oxide modified Titanium Dioxide as Electron Transport Layer in Formamidinium-Rich Perovskite Solar Cells

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Cross-sectional EDS spectra of the ETL

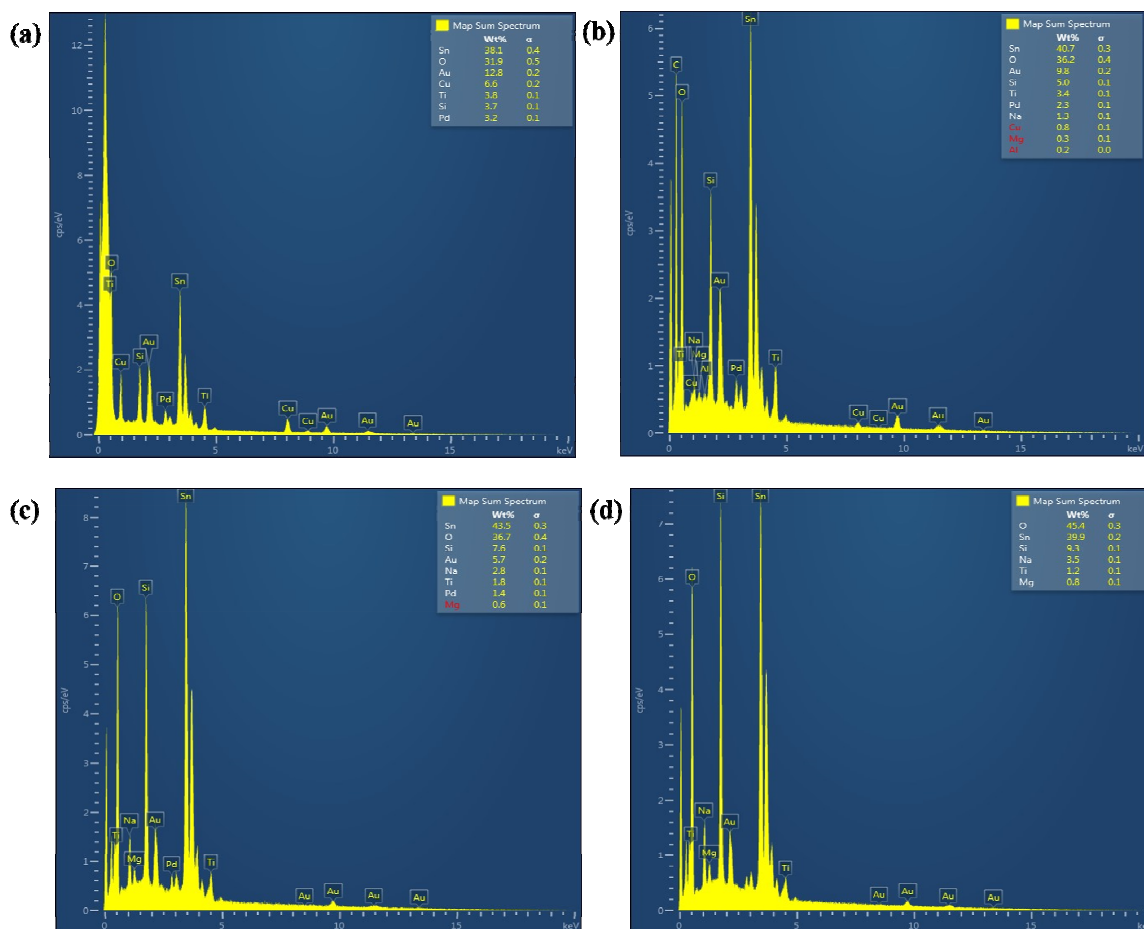


Figure S1: EDS spectra of ETL films for (a) TiO_2 and $\text{SnO}_2\text{-TiO}_2$ with (b) 0.1 (c) 0.2 (d) 0.3 proportion of SnO_2

Optical and electrical properties

Table S1: Bandgap and electrical conductivity of the ETL at different SnO_2 content

SnO_2 Proportion	0	0.1	0.2	0.3
Band gap (eV)	3.58 ± 0.030	3.59 ± 0.027	3.62 ± 0.046	3.70 ± 0.059
Conductivity, σ ($\times 10^{-4}$) (S/m)	1.27 ± 0.69	2.81 ± 0.81	2.83 ± 0.81	1.37 ± 0.34

TRPL Fitting parameters

Table S2: TRPL Bi-exponential fitting parameters

Vol. fraction of SnO ₂	0	0.1	0.2	0.3
A1	0.650 ± 0.016	0.676 ± 0.037	1.646 ± 0.037	1.476 ± 0.028
t1	2.774 ± 0.133	2.926 ± 0.129	0.541 ± 0.013	0.636 ± 0.022
A2	0.322 ± 0.016	0.245 ± 0.020	0.20 ± 0.008	0.255 ± 0.025
t2	16.38 ± 0.761	13.47 ± 0.82	3.97 ± 0.136	2.63 ± 0.149

Table S3: PV **performance** parameters of PSCs with different SnO₂ proportion in the ETL

Vol. fraction of SnO ₂	0	0.1	0.2	0.3
V _{oc} (V)	1.02 (1.01±0.019)	1.01 (0.994±0.011)	1.02 (1.00±0.016)	0.992 (0.967±0.018)
J _{sc} (mA/cm ²)	23.84 (22.39±1.41)	24.46 (23.61±0.68)	24.85 (23.9±0.81)	24.44 (23.33±1.06)
FF (%)	74.48 (69.71±3.81)	74.49 (69.79±3.14)	75.91 (70.55±3.59)	68.68 (65.58±4.14)
PCE (%)	18.18 (15.79±1.64)	18.29 (16.39±1.01)	18.78 (17.06.09±1.03)	16.03 (14.784±0.94)