

Supplementary Information

Ga-doped SnO₂ mesoporous contact for UV stable highly efficient perovskite solar cells

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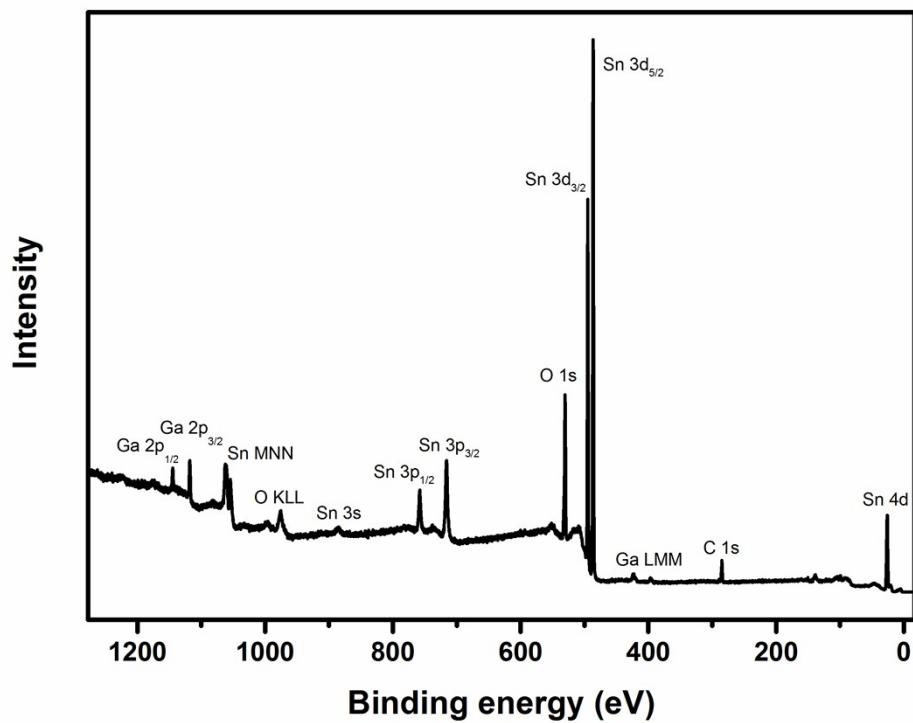
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SI 1: Full XPS spectrum of Ga-doped SnO₂

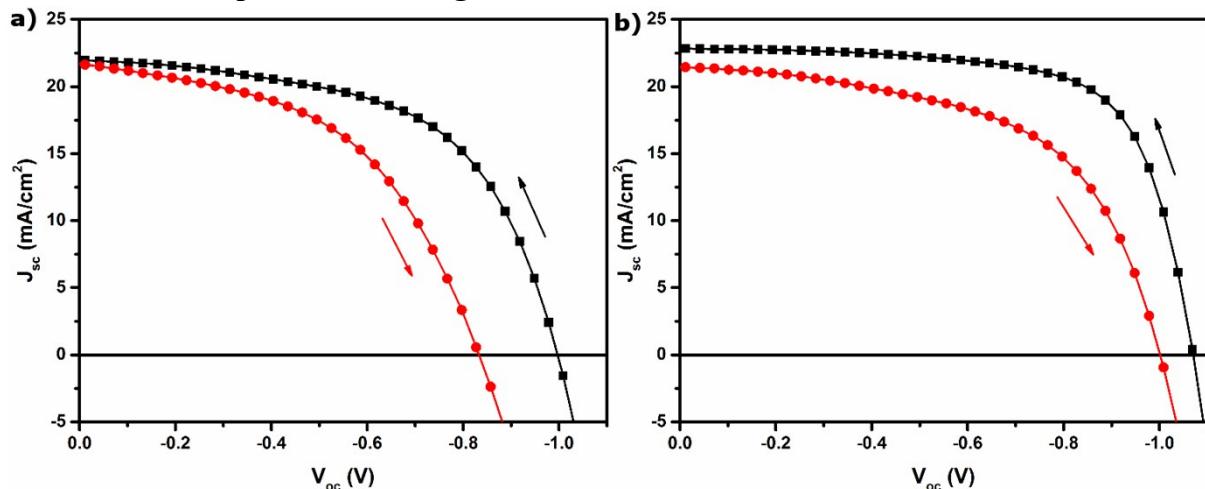


Full XPS spectrum of Ga-doped SnO₂, clearly showing the core levels of Ga, Sn and O.

SI 2: J - V parameters of Ga-doping optimization study (average of 5 devices)

Ga (%)	V_{oc} (mV)	J_{sc} (mA/cm ²)	FF (%)	PCE (%)
1.5	1008 ± 7	20.8 ± 0.6	62 ± 2	13.0 ± 0.4
2.0	997 ± 13	21.4 ± 0.4	62 ± 1	13.2 ± 0.4
2.5	1034 ± 16	21.5 ± 0.3	64 ± 1	14.2 ± 0.4
3.0	1024 ± 22	20.4 ± 0.9	63 ± 2	13.2 ± 0.8
3.5	1028 ± 21	20.6 ± 0.8	63 ± 1	13.4 ± 0.7

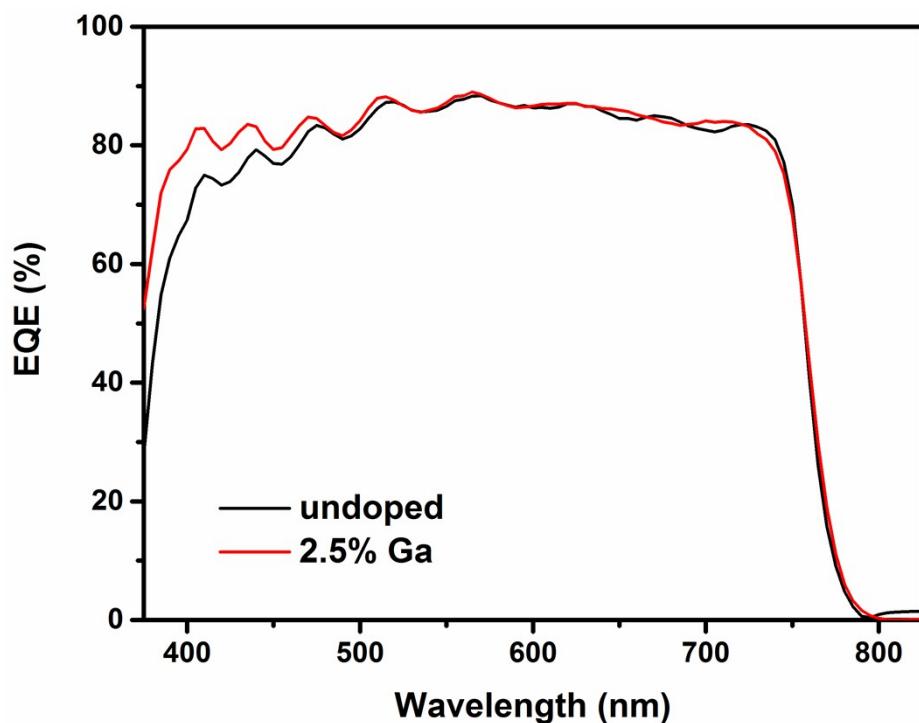
SI 3: Forward and backward scans of undoped (a) and 2.5% Ga-doped (b) m-SnO₂ based PSCs. J - V parameters are given in the table below.



Ga (%)	V_{oc} (mV)	(J_{sc} (mA/cm ²)	FF (%)	PCE (%)
0, reverse	997	22.0	57	12.5
0, forward	834	21.7	50	9.0
2.5, reverse	1070	22.8	70	17.0
2.5, forward	1003	21.5	56	12.0

SI 4: EQE of m-SnO₂ and 2.5% Ga-doped SnO₂ perovskite solar cells.

Integrated J_{sc} is calculated to be 19.4 mA/cm² and 19.9 mA/cm² for undoped and 2.5% Ga respectively. These values are in good agreement with the J_{sc} values extracted from J-V measurements.

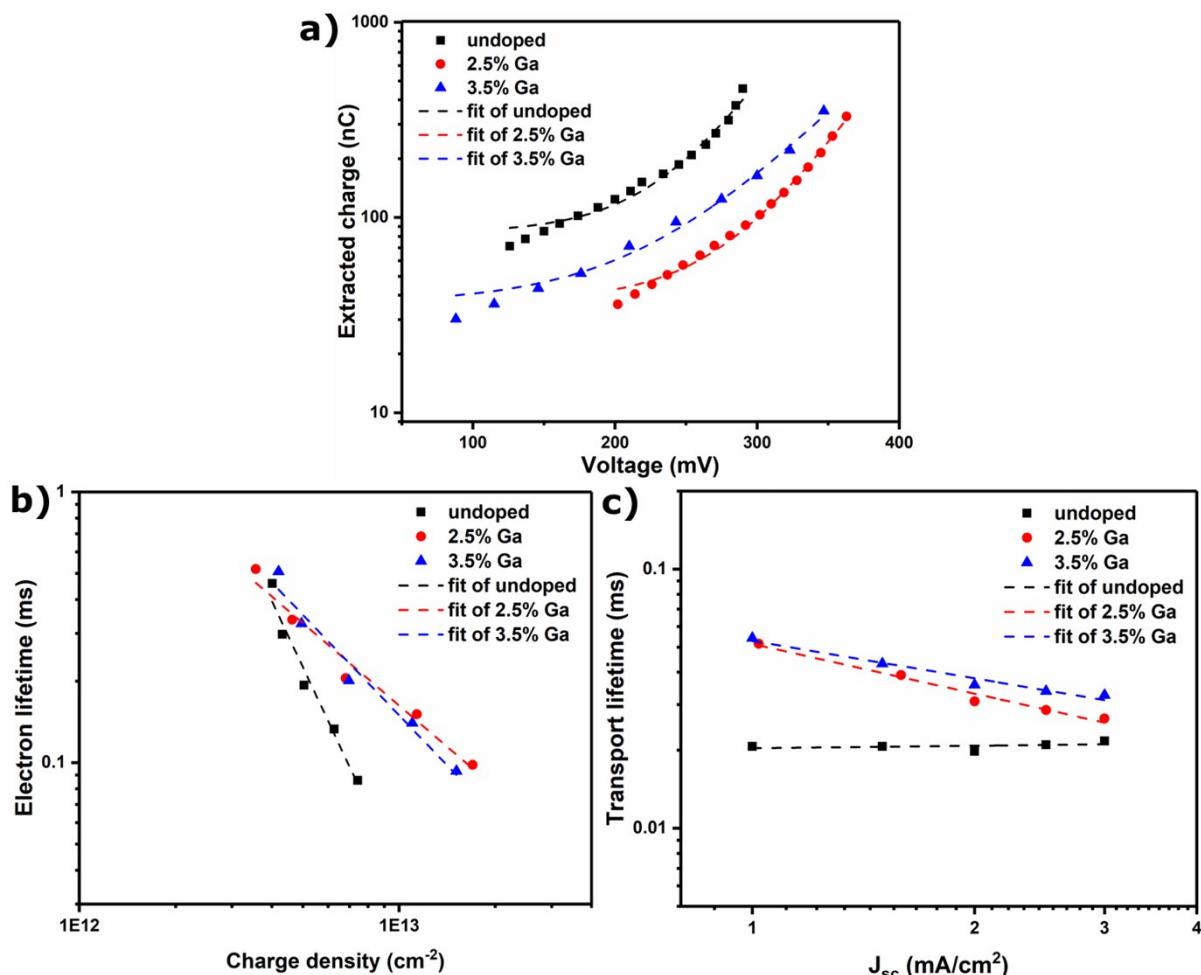


SI 5: J - V parameters of m-TiO₂ based PSCs (average of 5 devices)

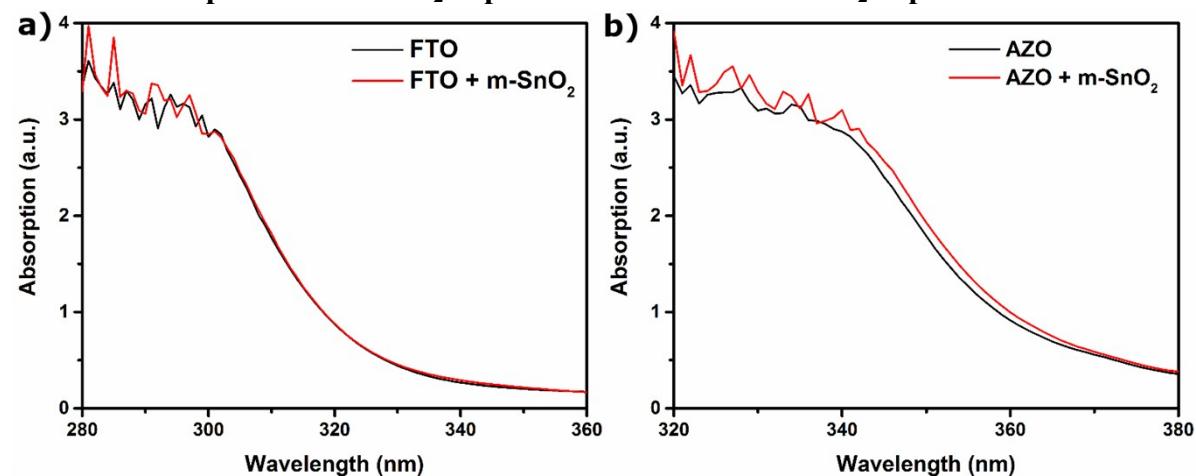
TCO	V_{oc} (V)	(J_{sc} (mA/cm ²)	FF (%)	PCE (%)
FTO	1032 ± 10	22.6 ± 1.0	72 ± 1	16.8 ± 0.6
AZO	1032 ± 4	21.0 ± 0.5	71 ± 1	15.5 ± 0.2

SI 6: Optoelectronic analysis of undoped, 2.5% and 3.5% Ga-doped m-SnO₂ devices

Optoelectronic analysis of undoped, 2.5% and 3.5% Ga-doped m-SnO₂ devices; a) Charge extracted at open circuit as a function of the voltage, b) Electron lifetime in solid-state DSSCs, as a function of open circuit voltage (V_{oc}), obtained through IMVS, d) Electron transport lifetimes in solid-state DSSCs as a function of the short circuit current (J_{sc}), obtained through IMPS. IMPS and IMVS data are well fit by a single exponential.



SI 7: UV/Vis spectra of m-SnO₂ deposited on FTO and m-TiO₂ deposited on AZO



SI 8: Normalized PCE of m-SnO₂ and m-TiO₂ as a function of time under full spectrum illumination (100 mW/cm²).

The devices were placed in a glovebox with N₂-atmosphere (~500 ppm O₂) during the illumination and were removed from the glovebox to extract the normalised PCE. After ~1000 hours of illumination, devices were stored in the dark and measured again after 200 hours.

