Supporting information

Low Temperature Solution Processed Indium Oxide Thin Films with Reliable Photoelectrochemical Stability for Efficient and Stable Planar Perovskite Solar Cells

Peng Chen, Xingtian Yin*, Meidan Que, Xiaobin Liu, Wenxiu Que*

Electronic Materials Research Laboratory, Key Laboratory of the Ministry of Education,

International Center for Dielectric Research, School of Electronic & Information Engineering,

Xi'an Jiaotong University, Xi'an 710049, Shaanxi, People's Republic of China

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* Corresponding author:

Tel.: +86-29-83395679; Fax: +86-29-83395679

Email address: wxque@mail.xjtu.edu.cn, xt_yin@mail,xjtu.edu.cn

Table S1.

Electron motilities of different metal oxides.

Metal oxide	Electron mobility ($cm^2 \cdot V^{-1} \cdot s^{-1}$)	Reference
In_2O_3	14~40 (film), 66~226 (single crystal film) 140~180 (bulk)	[1-3]
TiO_2	10^{-2} (porous, rutile), 1 (bulk, rutile) < 1.7 (nanocrystal, anatase)	[4, 5]
ZnO	120~155 (film), 200~205 (bulk)	[6]

Table S2.

The carriers' lifetime values for perovskite films on two kinds of IO films extracted by fitting TRPL spectra in figure 4d.

Substrate	Precursors	τ_1 (ns)	τ_2 (ns)
Indium oxide	w/o acacH	2.47	34.5
	with acacH	2.32	28.11

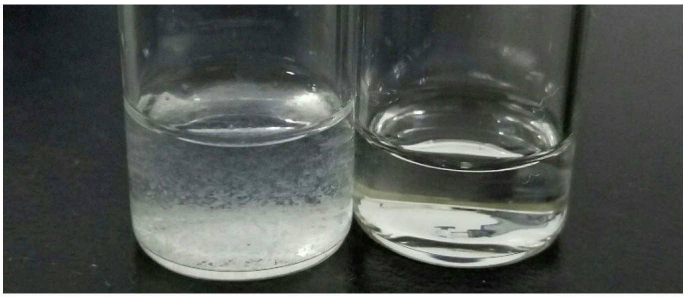

Figure S1. Photographs of In_2O_3 precursors with (right) and without (left) acetone stored for days.

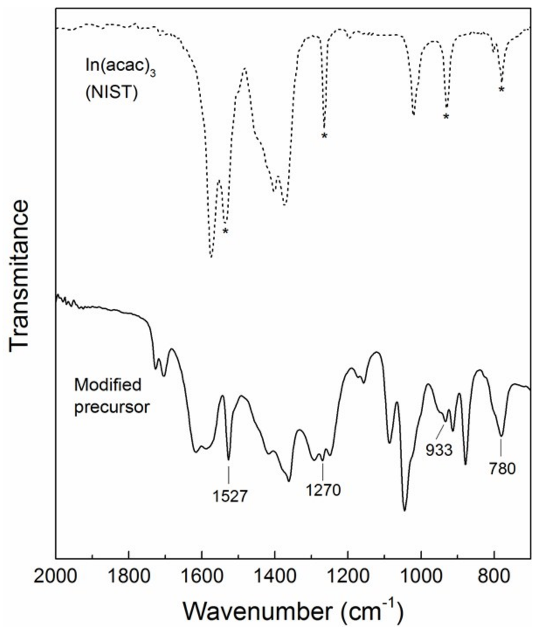

Figure S2. FI-IR spectrum of the modified IO precursor and the standard spectrum of $In(acac)_3$ from National Institute of Standard and Technology (NIST).

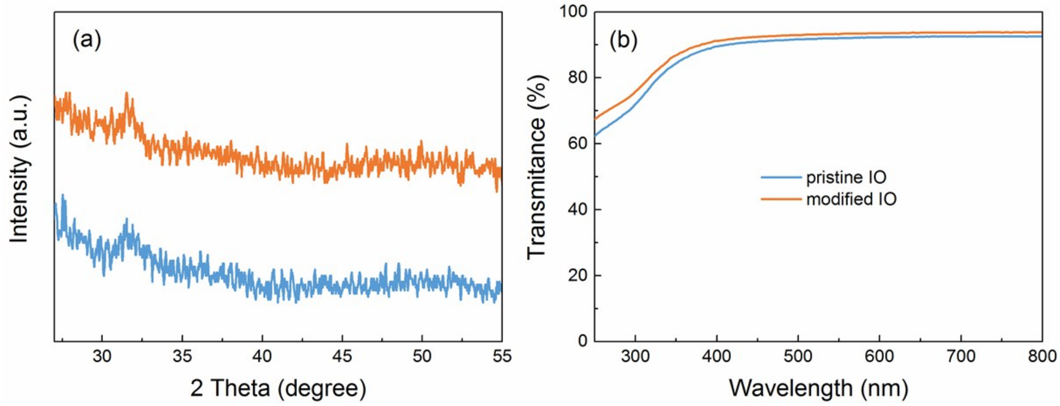

Figure S3. (a) XRD patterns and (b) UV-vis transmittance spectra of the pristine and modified IO films (annealed at 200 ^{o}C).

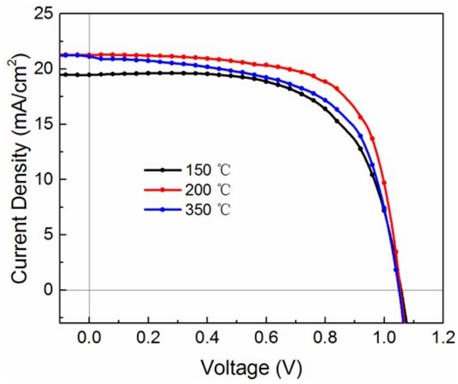

Figure S4. J-V curves of PSCs based on IO films annealed at 150 ℃, 200 ℃ and 350℃.

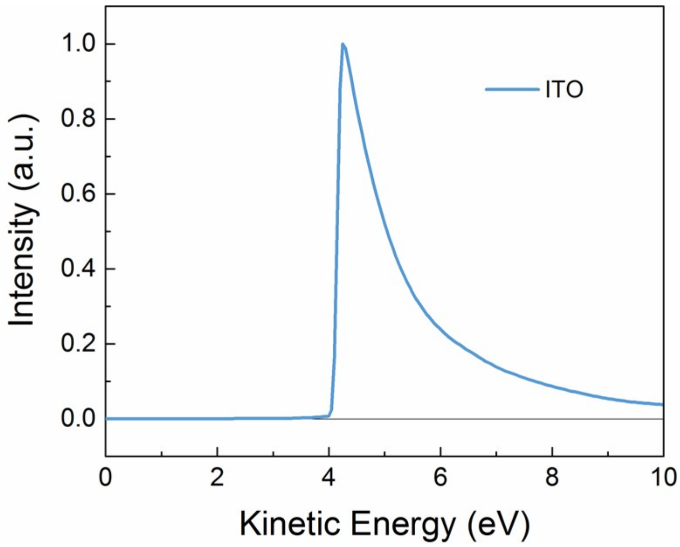

Figure S5. Ultraviolet photoelectron spectrum of the dried ITO substrate without any treatment.

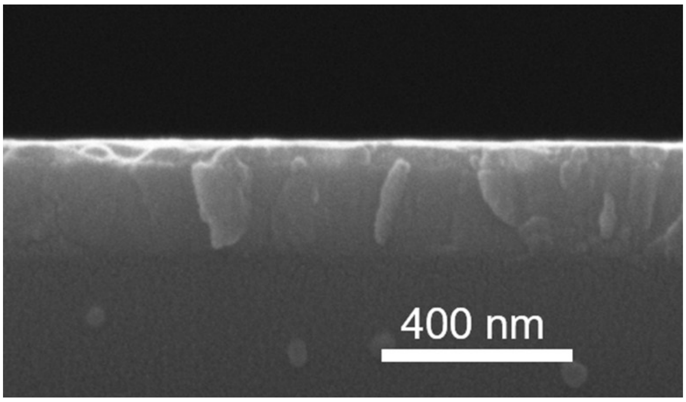

Figure S6. Cross-sectional SEM image of IO film spin-coated on ITO substrate with a thickness of ~40 nm.

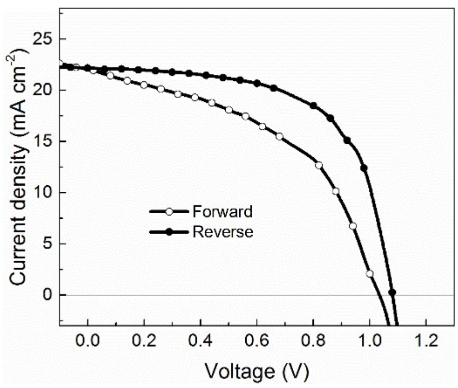

Figure S7. J-V curves of IO based perovskite solar cells measured by reverse and forward scans.

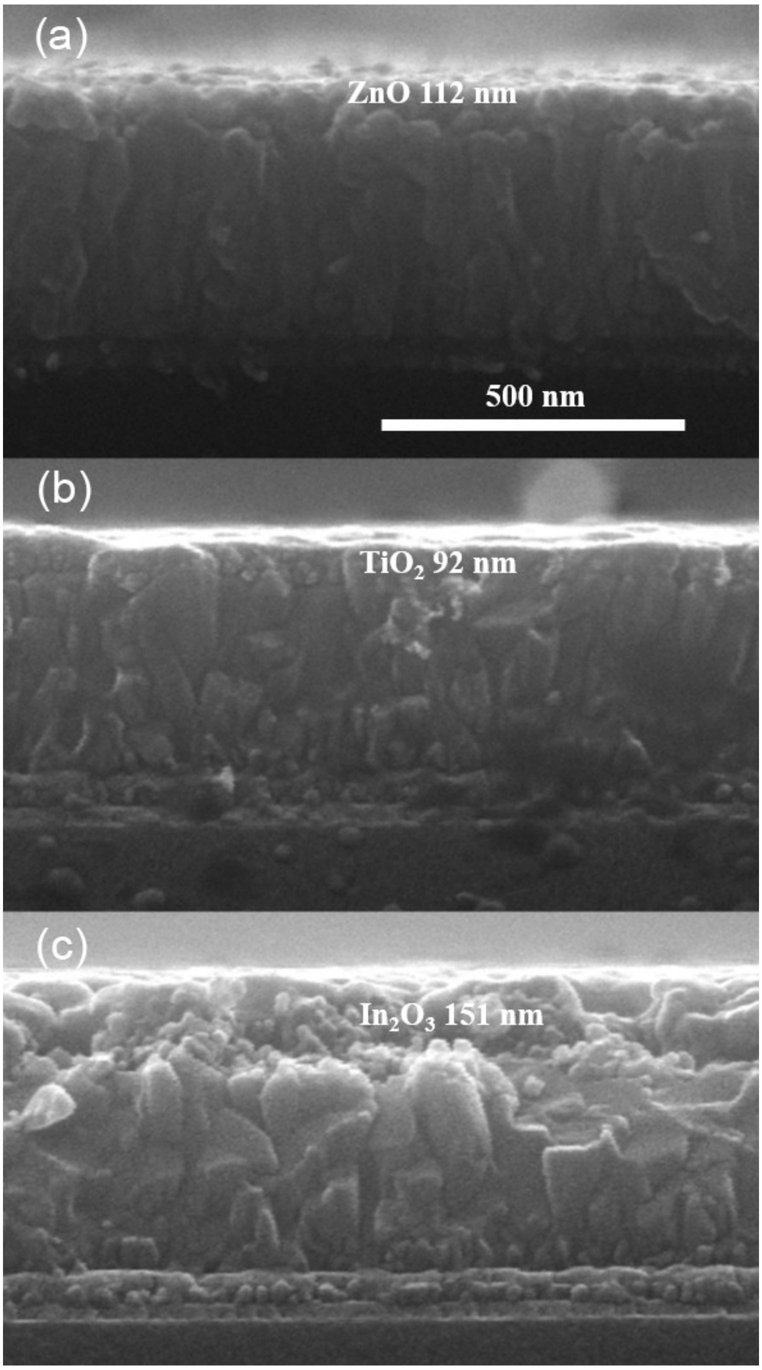

Figure S8. Cross-sectional SEM images of (a) ZnO, (b) TiO_2 and (c) In_2O_3 films on FTO substrates for the PEC test.

ZnO film: To prepare the precursor, 0.611g ethanolamine and 20 ml 2-methoxyethanol were firstly mixed, then 2.195 g zinc acetate dihydrate was added in the mixture. The mixture was stirred at 60 ℃ for 30 min and then aged for 12 h. The ZnO film was spin-coated on FTO substrates and annealed at 200℃ for 10 min and 500 ℃ for 30 min.

TiO_2 film: The precursor was prepared by dissolving 109 mg diethanolamine, 471 mg tetrabutyl titanate in 10 ml ethanol. The mixture was stirred overnight and then aged for 24 h. After that, the same spin-coating and annealing programs were employed to deposit TiO_2 film on FTO substrates.

References

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