Supporting information

Buried Interface Management toward High-Performance Perovskite Solar Cells†

Bin Du[a#*], Yuexin Lin[b#], Jintao Ma[a], Weidan Gu[a], Fei Liu[a], Yijun Yao[c*], and Lin Song[d*]

[a] *School of Materials Science and Engineering, Xi'an Polytechnic University, Xi'an 710048, China*

[b] *MOE Key Laboratory for Nonequilibrium Synthesis and Modulation of Condensed Matter, School of Physics, National Innovation Platform (Center) for Industry-Education Integration of Energy Storage Technology, Xi'an Jiaotong University, Xi'an 710049, P. R. China*

[c] *School of Textile Science and Engineering, Xi'an Polytechnic University, Xi'an, 710048, Shaanxi, China*

[d] *Frontiers Science Center for Flexible Electronics (FSCFE), Institute of Flexible Electronics (IFE), Northwestern Polytechnical University, Xi'an 710072, China*

[#] Authors share equal authorship

† Electronic supplementary information (ESI) available.

* dubin@xpu.edu.cn (B. D)

* yaoyj@xpu.edu.cn (Y. Y)

* iamlsong@nwpu.edu.cn (L. S)

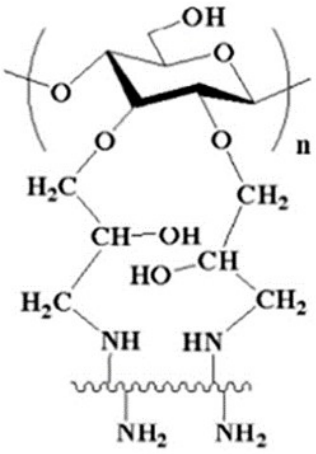

Fig. S1. Structure diagram of the molecular formula of GCC.

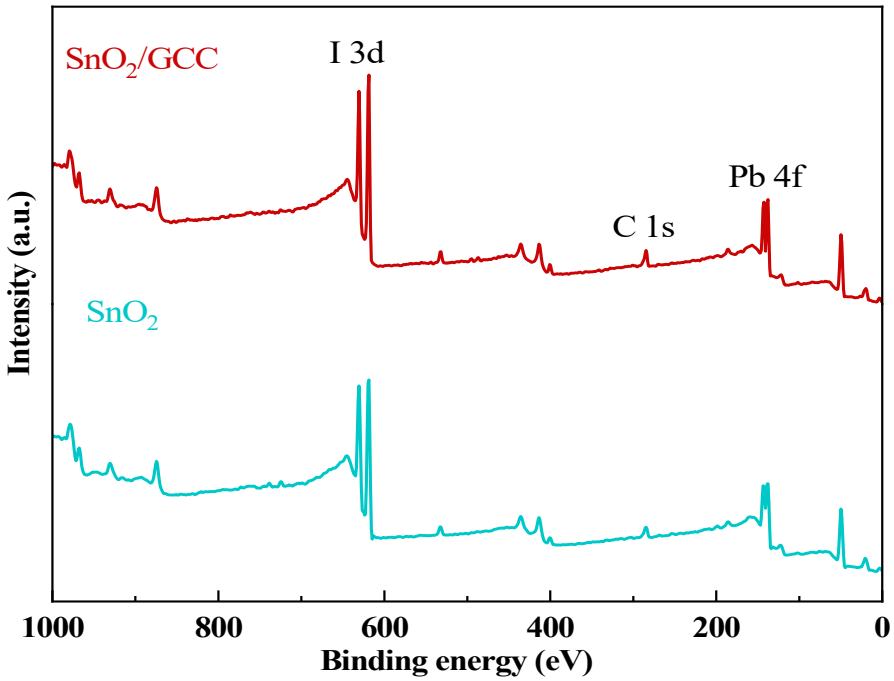

Fig. S2. XPS full spectra of SnO_2 and SnO_2/GCC.

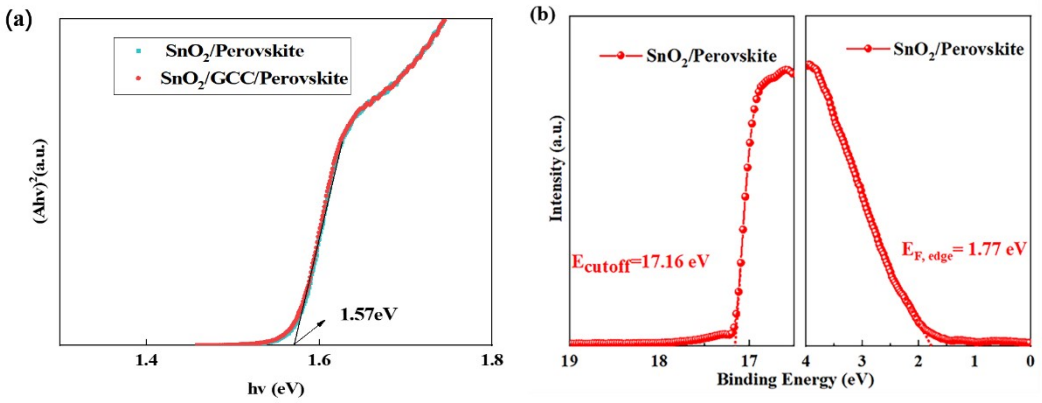

Fig. S3. (a) Tauc-Plot spectrum of perovskite films deposited on SnO_2/Perovskite substrate. (b) UPS spectra of SnO_2/Perovskite film.

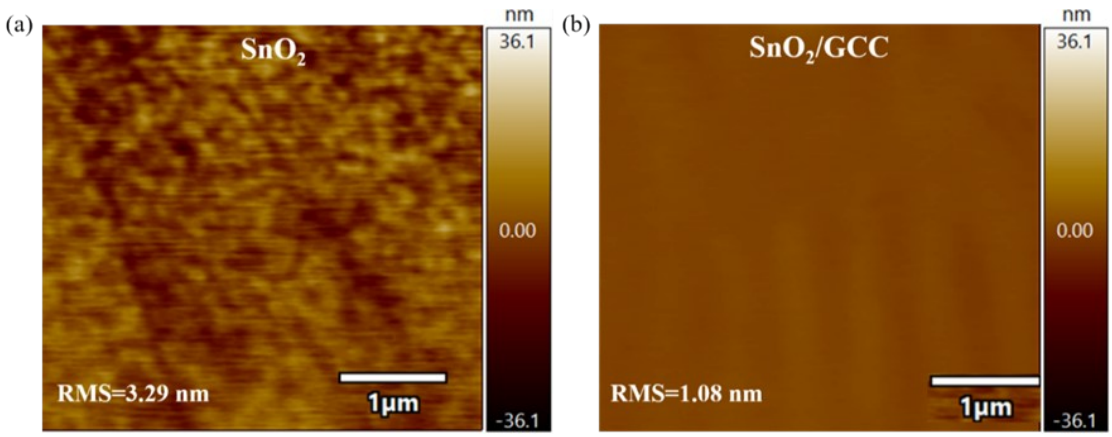

Fig. S4. AFM images of (a) SnO_2 and (b) SnO_2/GCC films.

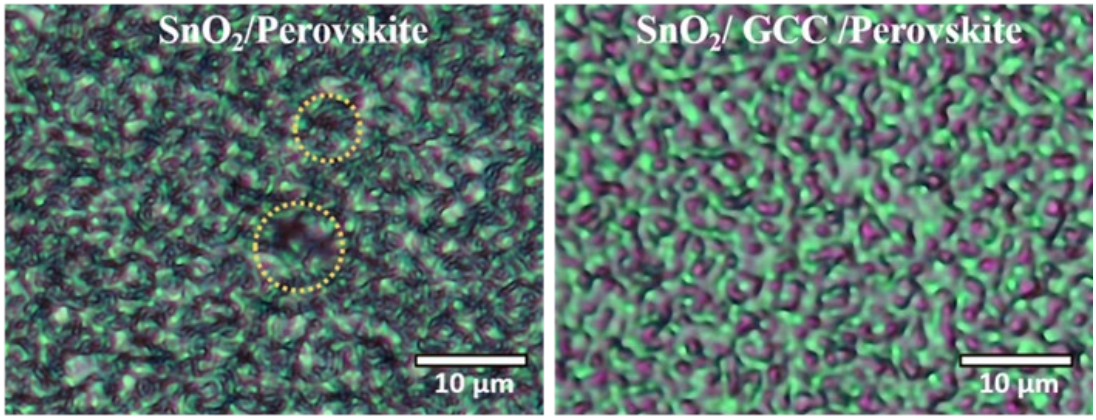

Fig. S5. OM images of perovskite films deposited on (a) SnO_2 and (b) SnO_2/GCC ETLs.

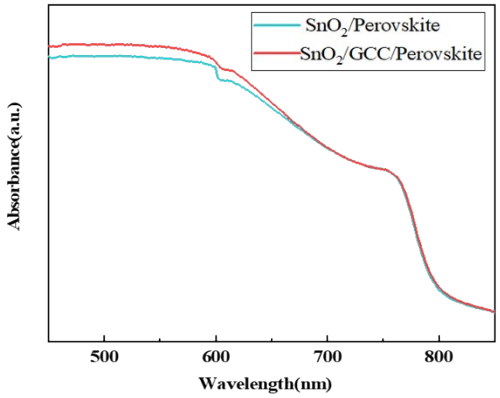

Fig. S6. UV-vis absorption spectra of perovskite films deposited on SnO_2 and SnO_2/GCC ETLs.

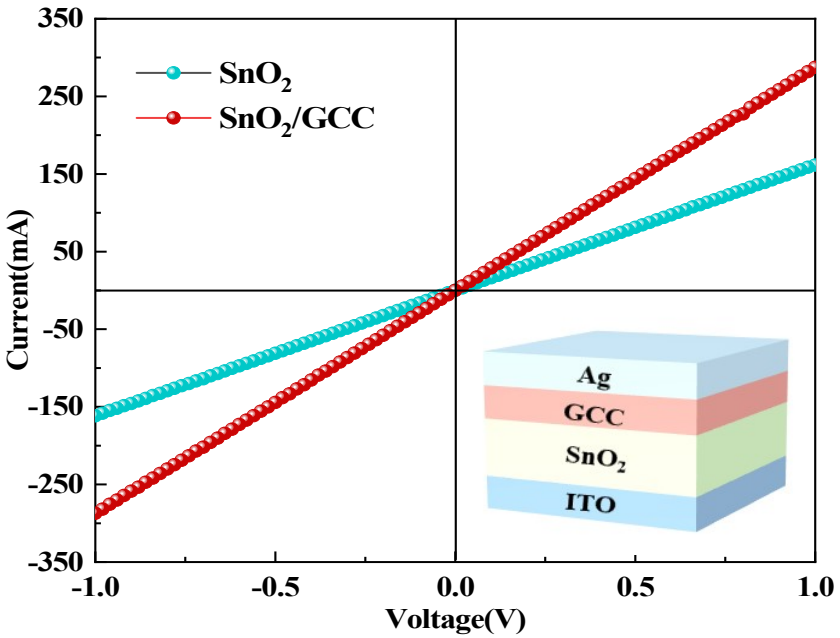

Fig. S7. *I*−*V* curves of devices based on SnO_2 and SnO_2/GCC ETLs. The inset depicts the device structure.

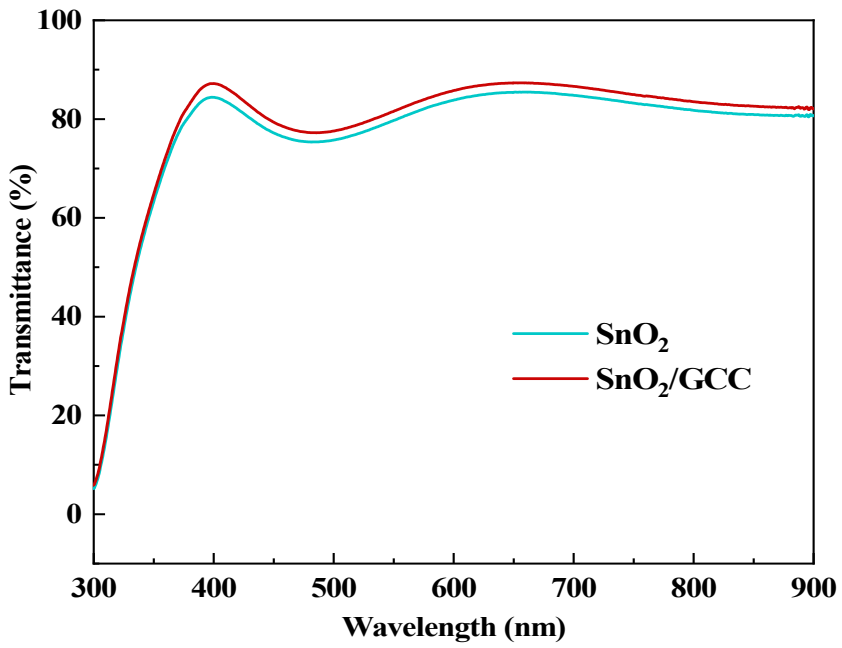

Fig. S8. UV-vis absorption spectra of SnO_2 and SnO_2/GCC ETLs.

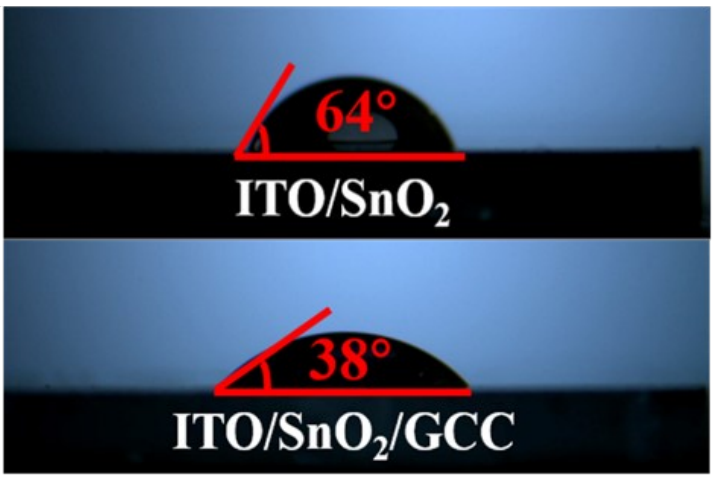

Fig. S9. The contact angle measurements of ITO/SnO_2 and ITO/SnO_2/GCC ETLs.

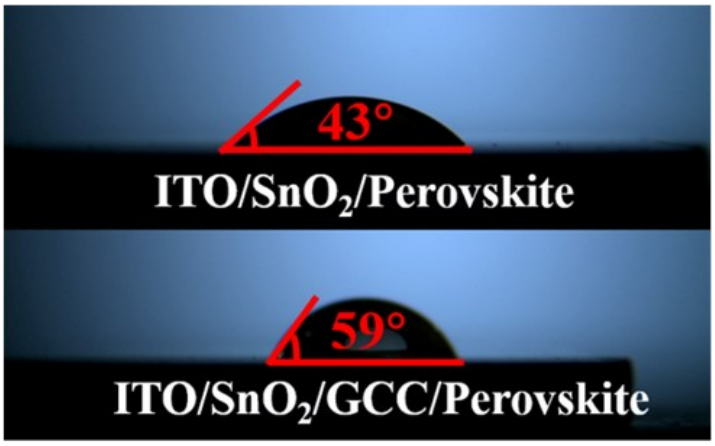

Fig. S10. The contact angle measurements of perovskite precursor solution on ITO/SnO_2 and $ITO/SnO_2/GCC$.

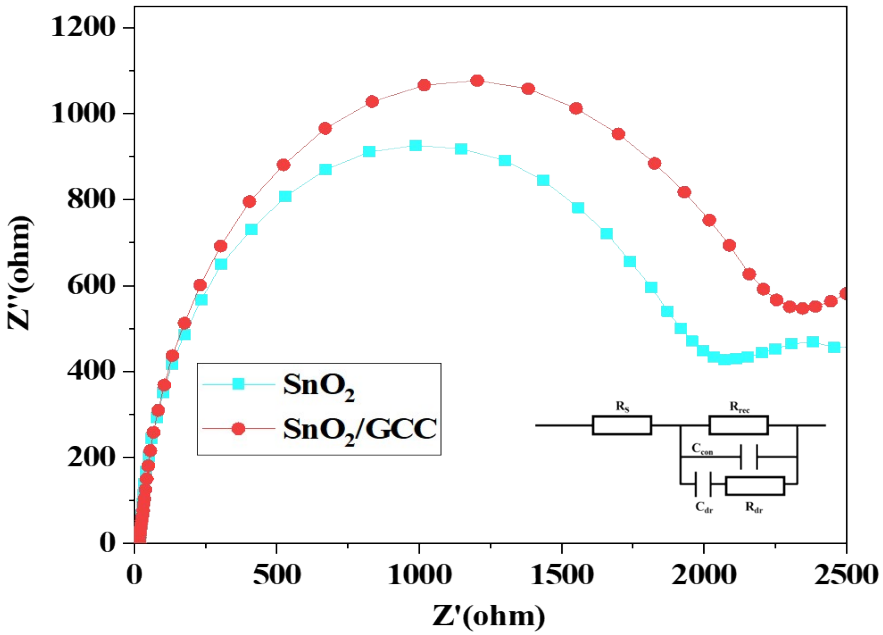

Fig. S11. Ectrochemical impedance spectroscopy (EIS) at a bias of 0.9 V under dark conditions.

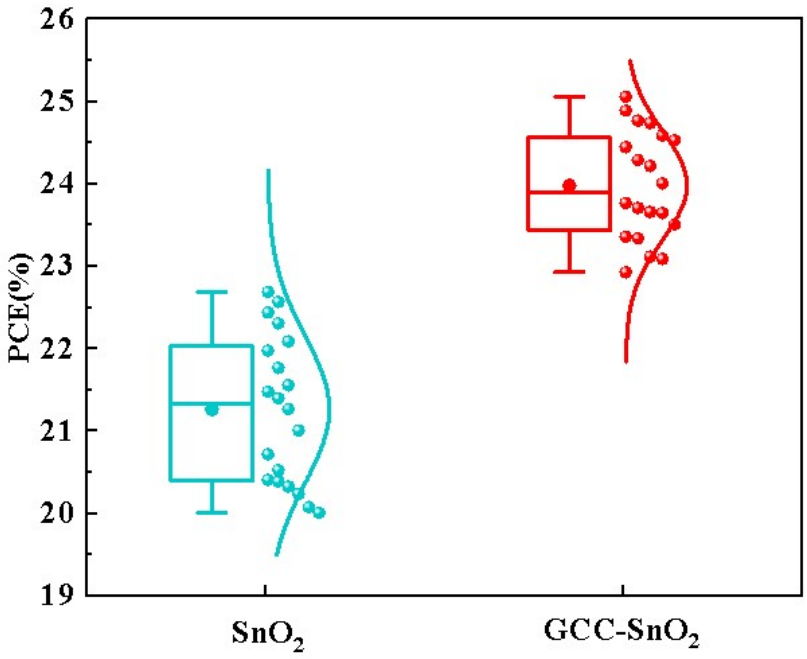

Fig. S12. PCE statistical data of SnO_2 and GCC-SnO_2.

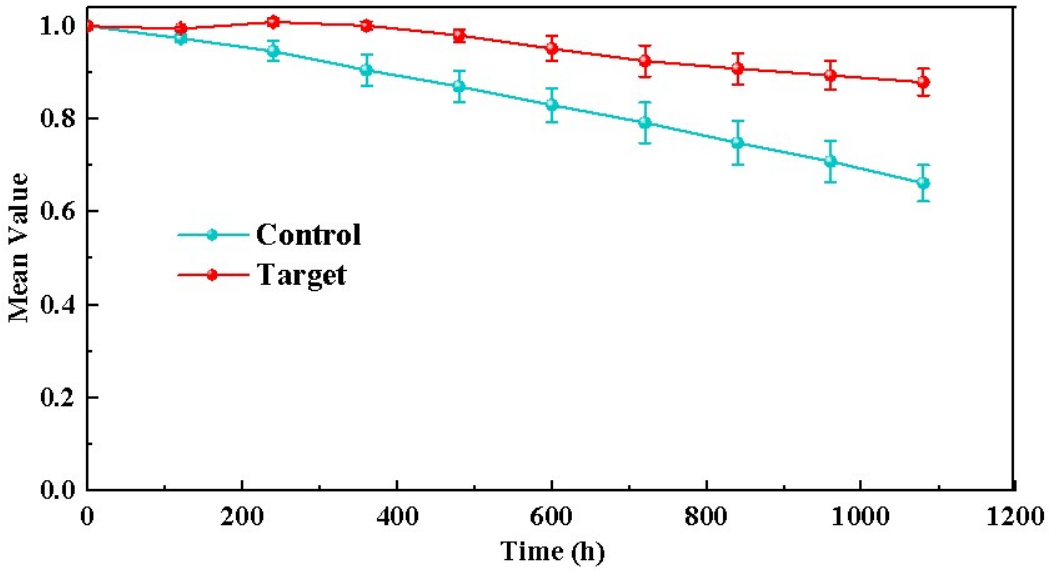

Fig. S13. Long term stability of unencapsulated PSC manufactured on raw and GCC modified SnO_2 measured in ambient air after 1200 hours.

Table S1. Calculated parameters for the energy level of SnO_2 and SnO_2/GCC.

Sample	E_{cutoff} (eV)	W_F (eV)	$E_{F, edge}$ (eV)	E_{VB} (eV)	E_g (eV)	E_{CB} (eV)
SnO_2	**16.61**	**4.61**	**3.92**	**-8.53**	**3.90**	**-4.63**
SnO_2/GCC	**16.57**	**4.65**	**3.73**	**-8.38**	**3.90**	**-4.48**

Table S2. The fitted data of TRPL curves.

Sample	τ_1 (ns)	τ_2 (ns)	A_1	A_2	τ_{ave}(ns)
SnO_2/Perovskite	79.06	1081.57	27.12%	72.88%	809.69
SnO_2/GCC/Perovskite	56.18	889.96	20.34%	79.66%	719.37

Table S3. The photovoltaic parameters of the PSCs prepared with and without GCC modification were measured in the reverse scan (RS) and forward scan (FS).

	Sweep direction	V_{OC} (V)	J_{SC} (mA cm^{-2})	FF (%)	PCE (%)	Hysteresis index
Control	Reverse	1.13	24.70	81.04	22.69	0.045
	Forward	1.13	24.66	77.65	21.68	
Target	Reverse	1.17	25.59	83.61	25.06	0.024
	Forward	1.16	25.59	82.53	24.41	