Electronic Supplementary Information

Ultrathin SiO_2 blocking layer to suppress interfacial recombination for efficient Sb_2S_3-sensitized solar cells

Yafeng Xu,[ab] Wenyong Chen,[ab] Xihong Ding,[d] Xu Pan,[a] Linhua Hu,[a] Shangfeng Yang,[b] Jun Zhu,[*ac] and Songyuan Dai[*d]

[a]Key Laboratory of Photovoltaic and Energy Conservation Materials, Institute of Applied Technology, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei 230031, China

[b]Hefei National Laboratory for Physical Sciences at Microscale, Key Laboratory of Materials for Energy Conversion, Chinese Academy of Sciences, Department of Materials Science and Engineering, Synergetic Innovation Center of Quantum Information & Quantum Physics, University of Science and Technology of China, Hefei 230026, China

[c]National Engineering Lab of Special Display Technology, State Key Lab of Advanced Display Technology, Academy of Opto-Electronic Technology, Anhui Provincial Key Laboratory of Advanced Functional Materials and Devices, Hefei University of Technology, Hefei 230009, China

[d]Beijing Key Laboratory of Novel Thin Film Solar Cells, North China Electric Power University, Beijing 102206, China

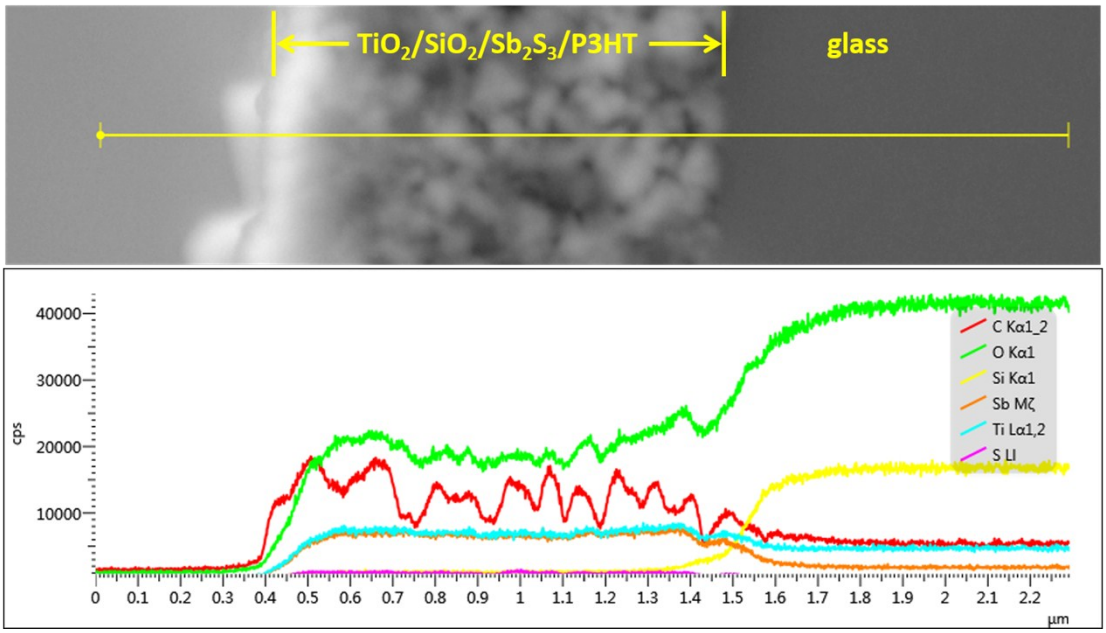

Fig. S1 Cross-sectional SEM image and energy dispersive X-ray spectroscopy (EDS) line scan of $TiO_2/SiO_2/Sb_2S_3$/P3HT film deposited on glass. Glass was used instead of FTO coated glass to avoid the misinterpretation between Sb in Sb_2S_3 and Sn in FTO.

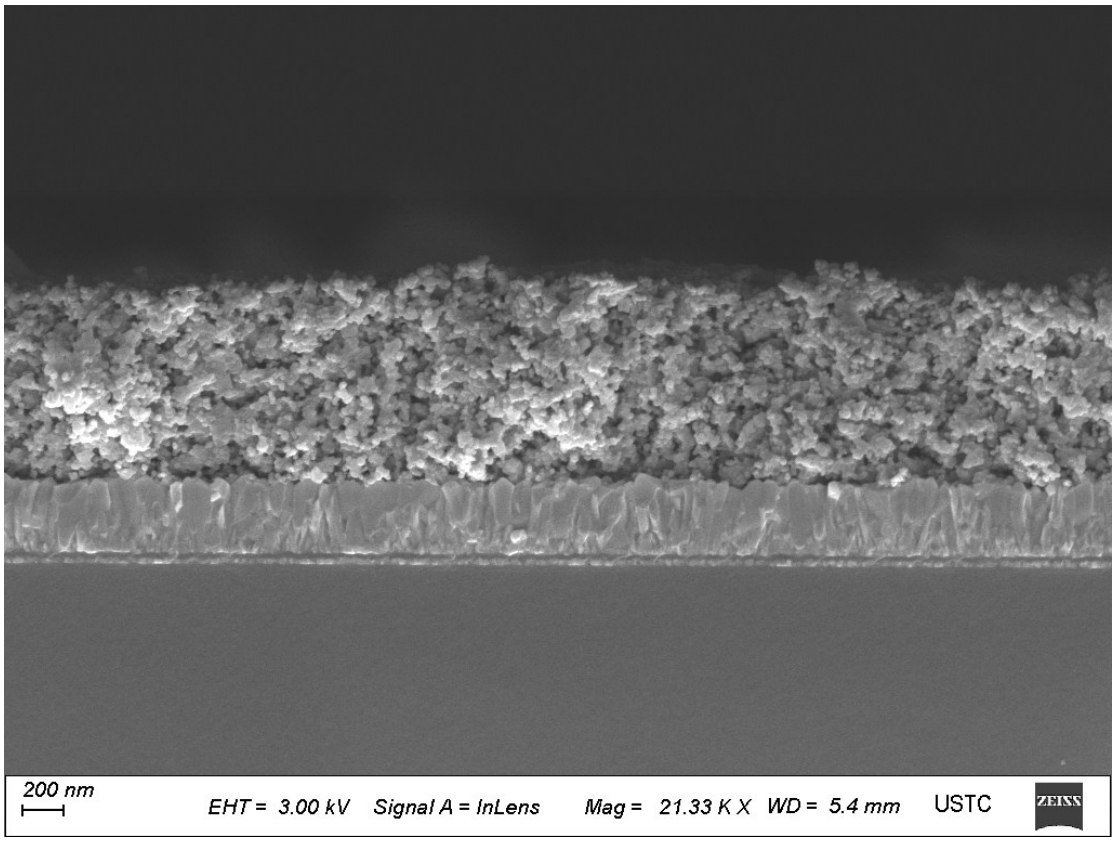

Fig. S2 Cross-sectional SEM image of the TiO_2/SiO_2/crystalline Sb_2S_3 mesoporous

film.

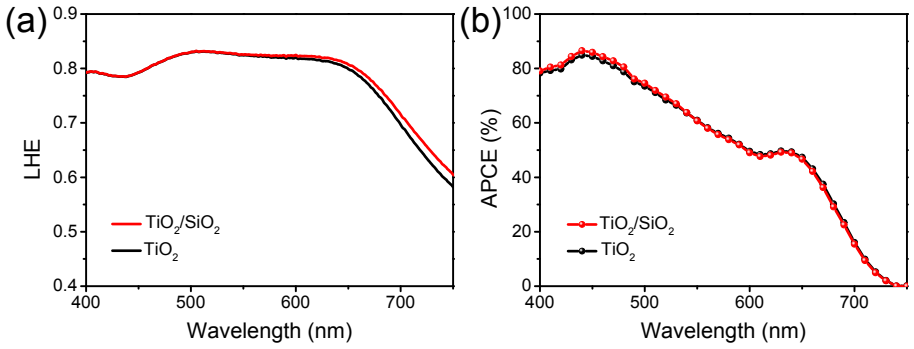

Fig. S3 (a) LHE and (b) APCE spectra of the Sb_2S_3-sensitized solar cells based on TiO_2 and TiO_2/SiO_2 mesoporous films.

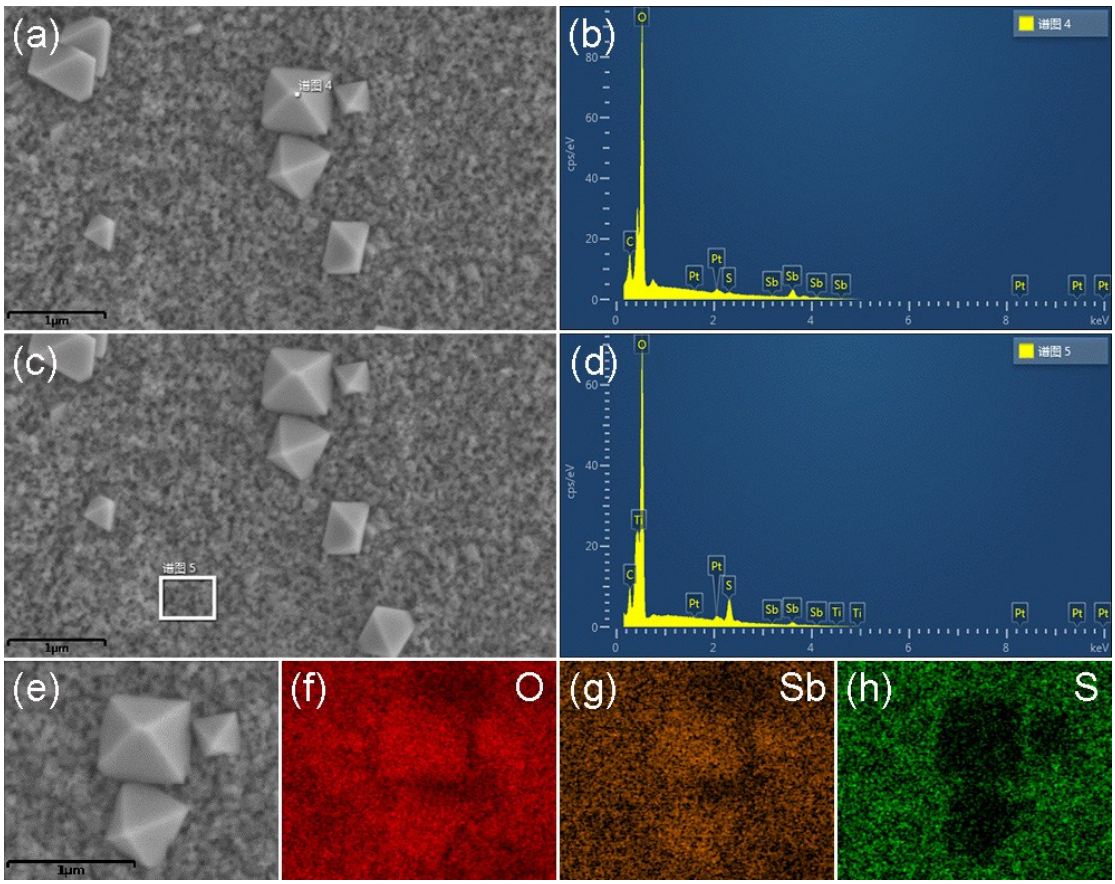

Fig. S4 SEM images of (a), (c) Sb_2S_3-sensitized TiO_2 mesoporous films with octahedral particles on the surface, typical EDS spectra of (b) a octahedral particle and (d) Sb_2S_3-sensitized TiO_2 films, SEM image of (e) octahedral particles, oxygen (f), antimony (g) and sulphur (h) EDS element mapping images of the octahedral particles.

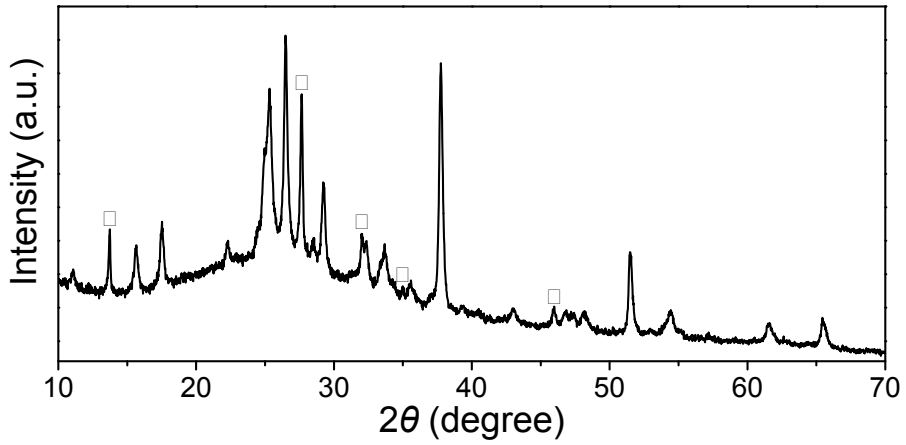

Fig. S5 X-ray diffraction pattern of a typical Sb_2S_3-sensitized TiO_2 film. The stars mark the peaks indexed to Sb_2O_3 (JCPDS 43-1071).

Table S1 Photovoltaic performances of Sb_2S_3-sensitized solar cells with SiO_2 layer deposited on Sb_2S_3 absorber.

	V_{OC} (V)	J_{SC} (mA/cm^2)	FF (%)	Efficiency (%)
TiO_2/Sb_2S_3/P3HT	0.523	10.16	56.5	3.00
TiO_2/Sb_2S_3/SiO_2/P3HT	0.498	10.07	55.6	2.79

Table S2 Photovoltaic performances of all Sb_2S_3-sensitized solar cells.

	V_{OC} (V)	J_{SC} (mA/cm^2)	Fill Factor (%)	Efficiency (%)
TiO_2-1	0.487	6.34	50.5	1.56
TiO_2-2	0.478	7.22	49.8	1.72
TiO_2-3	0.488	7.86	52.2	2.00
TiO_2-4	0.473	8.34	51.2	2.02
TiO_2-5	0.462	9.47	51.5	2.25
TiO_2-6	0.472	8.80	54.5	2.26
TiO_2-7	0.487	9.00	52.0	2.28
TiO_2-8	0.490	9.55	51.2	2.40
TiO_2-9	0.446	10.93	50.3	2.45
TiO_2-10	0.424	11.27	56.4	2.70
TiO_2-11	0.504	10.27	52.3	2.70
TiO_2-12	0.434	11.36	56.4	2.79
TiO_2-13	0.512	9.81	58.1	2.92
TiO_2-14	0.446	10.41	64.2	2.98
TiO_2-15	0.523	10.16	56.5	3.00

TiO_2/SiO_2-1	0.496	9.17	54.0	2.46
TiO_2/SiO_2-2	0.519	8.93	54.5	2.53
TiO_2/SiO_2-3	0.492	10.86	53.1	2.84
TiO_2/SiO_2-4	0.461	11.29	56.3	2.93
TiO_2/SiO_2-5	0.541	9.90	55.1	2.95
TiO_2/SiO_2-6	0.470	10.88	60.8	3.11
TiO_2/SiO_2-7	0.468	10.97	60.7	3.12
TiO_2/SiO_2-8	0.559	9.26	61.7	3.19
TiO_2/SiO_2-9	0.465	11.17	63.2	3.28
TiO_2/SiO_2-10	0.546	10.24	60.1	3.36
TiO_2/SiO_2-11	0.479	11.06	63.9	3.39
TiO_2/SiO_2-12	0.526	11.99	54.5	3.44
TiO_2/SiO_2-13	0.509	11.88	57.1	3.45
TiO_2/SiO_2-14	0.551	10.34	66.1	3.77
TiO_2/SiO_2-15	0.558	10.44	68.1	3.96