Supporting Information

Cerium oxide standing out as electron transport layer for efficient and stable perovskite solar cells processed in low-temperature

Xin Wang,[a] Lin-Long Deng,*[a] Lu-Yao Wang, [a] Si-Min Dai,[b] Zhou Xing,[b] Xin-Xing Zhan,[b] Xu-Zhai Lu, [b] Su-Yuan Xie,*[b] Rong-Bin Huang[b] and Lan-Sun Zheng[b]

[a]*Pen-Tung Sah Institute of Micro-Nano Science and Technology, Xiamen University, Xiamen 361005, China. *E-mail: denglinlong@xmu.edu.cn*

[b]*State Key Lab for Physical Chemistry of Solid Surfaces, iChEM (Collaborative Innovation Center of Chemistry for Energy Materials), Department of Chemistry, College of Chemistry and Chemical Engineering, Xiamen University, Xiamen 361005, China. *E-mail: syxie@xmu.edu.cn*

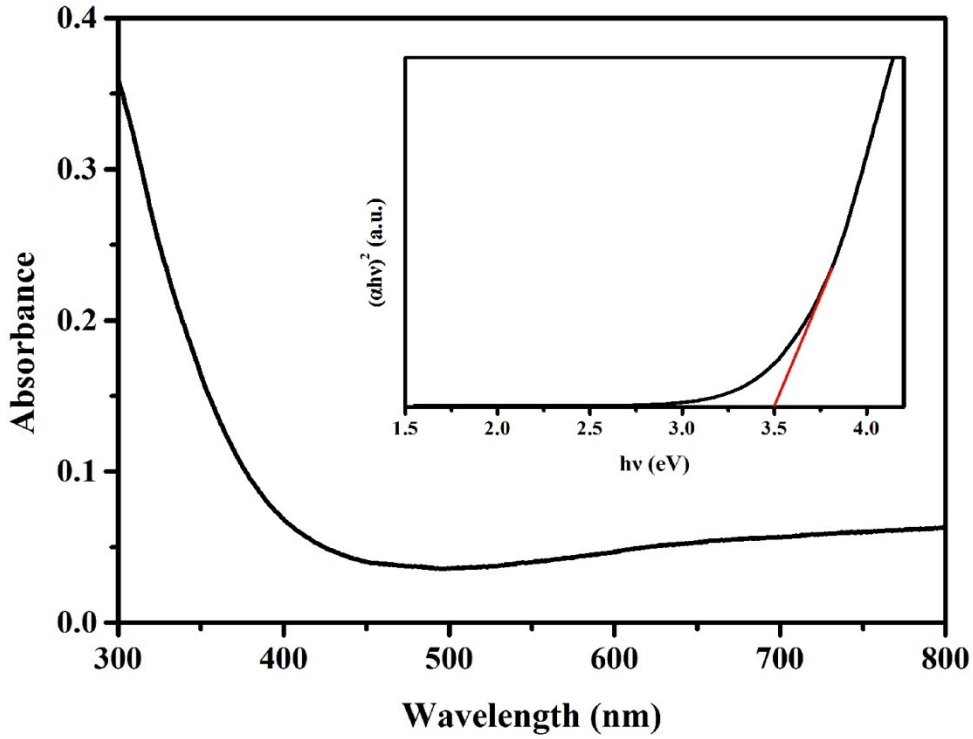

Figure S1 UV-vis absorption spectra of CeO_x film. The inset shows the Tauc plot for band gap determination.

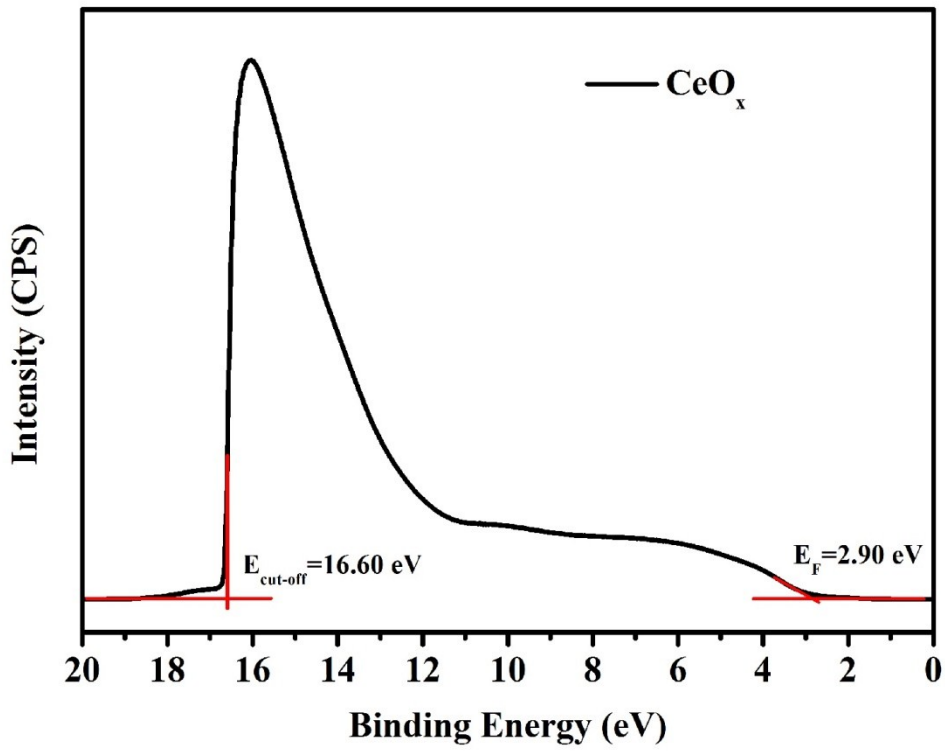

Figure S2 UPS spectra of CeO_x film.

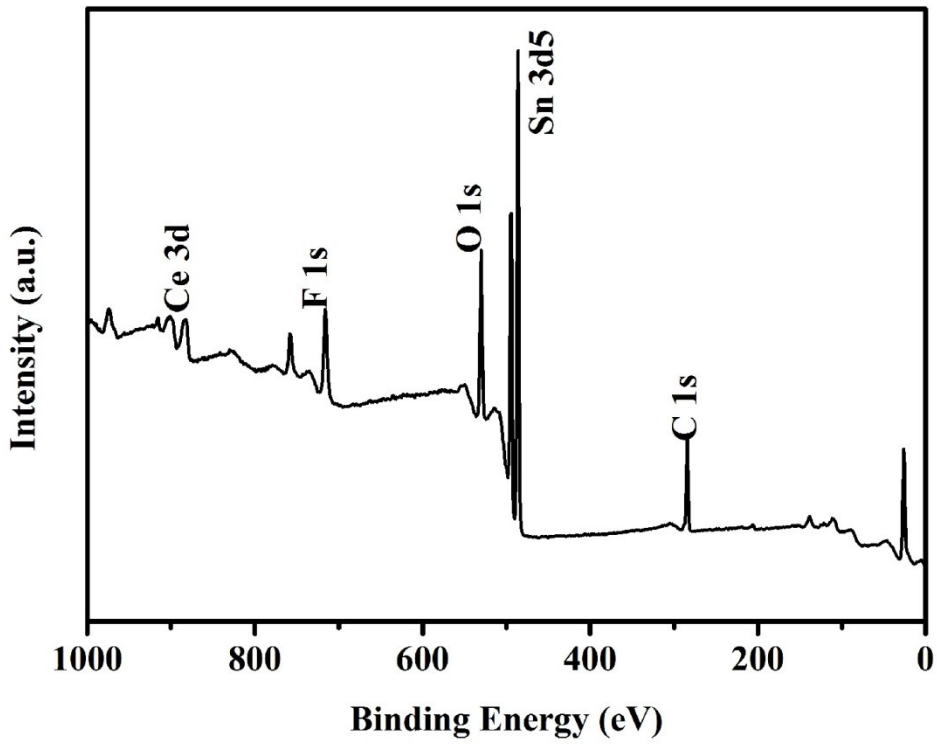

Figure S3 XPS survey scan of CeO_x film spin-coated on FTO substrate.

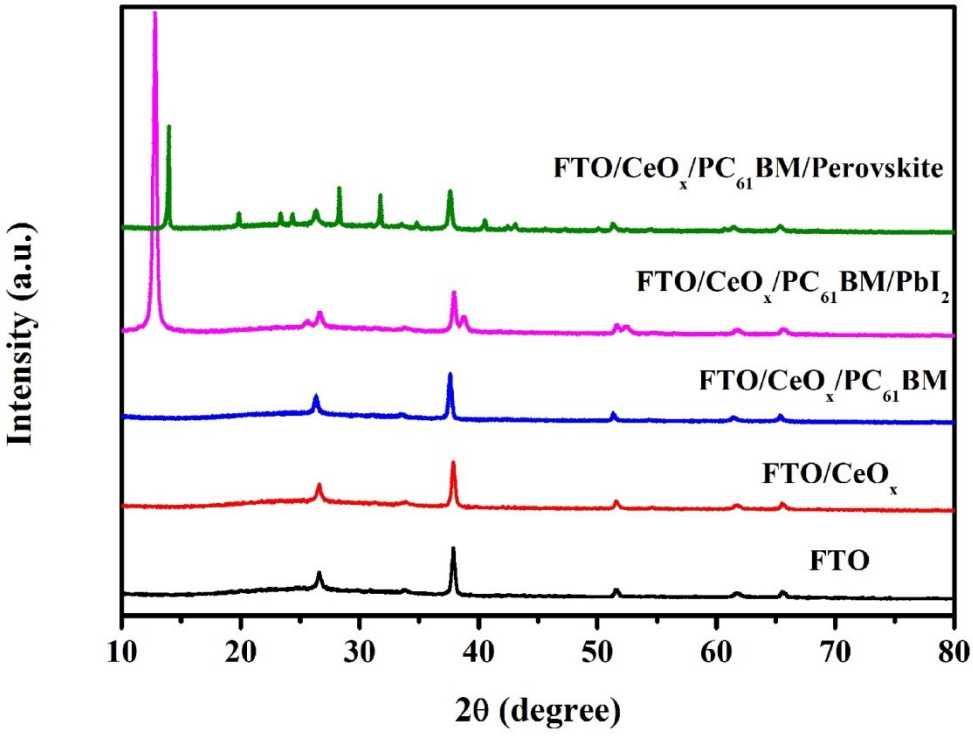

Figure S4 XRD patterns of FTO, FTO/CeO_x, FTO/CeO_x/$PC_{61}BM$, FTO/CeO_x/$PC_{61}BM$/PbI_2, and FTO/CeO_x/$PC_{61}BM$/$CH_3NH_3PbI_3$ on glass substrates.

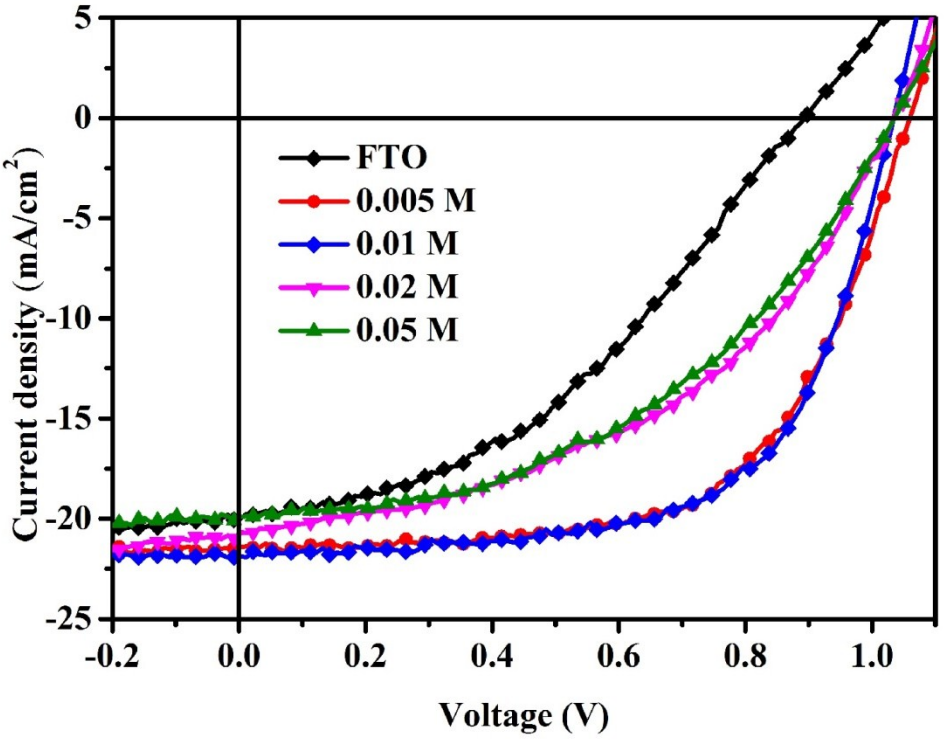

Figure S5 *J-V* curves of PSCs based on CeO_x ETL prepared by different precursor concentrations.

Table S1 Photovoltaic parameters of PSCs without and with different CeO_x films.

Molarity	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	PCE (%)
FTO	0.93	19.87	41.16	7.61
0.005	1.05	21.44	61.38	13.82
0.01	1.04	21.93	62.79	14.32
0.02	1.03	20.65	45.82	9.75
0.05	1.03	20.02	45.57	9.40

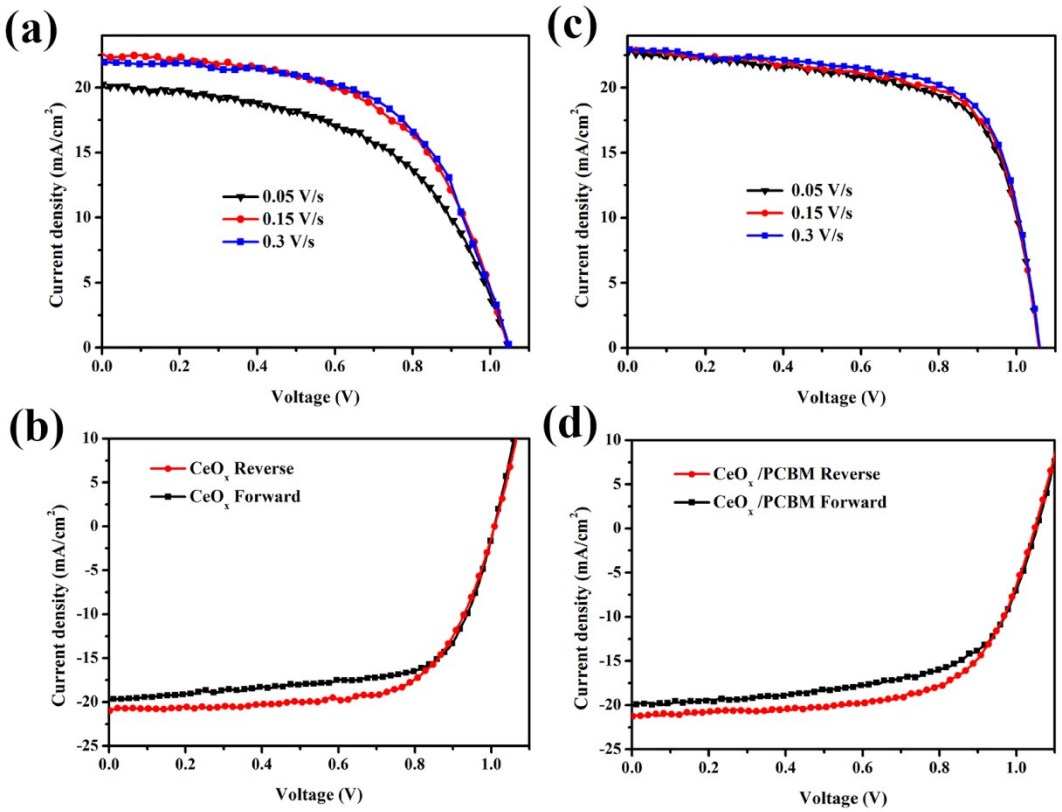

Figure S6 *J-V* curves of the CeO_x-based PSCs without (a, b) and with (c, d) a $PC_{61}BM$ layer measured with different scan rates (reverse scan) and different scan directions under simulated AM1.5G 100 $mWcm^{-2}$ illumination.