

Supporting Information

Performance enhancement of perovskite solar cells with the modified TiO₂ electron transport layer using Zn-based additives

Minghang Lv, Wei Lv, Xiang Fang, Peng Sun, Bencai Lin, Shuai Zhang, Xueqing Xu, Jianning

Ding* and Ningyi Yuan*

Table S1: EDX parameters for normalized atomic percentage of none-doped TiO₂ and 0.02ZTP based ETL films.

	O	C	Si	Na	Ca	Mg	Ti	Al	Zn
None-doped TiO ₂	65.17	13.98	11.49	5.59	1.64	0.96	0.98	0.19	
0.02ZTP	61.97	14.08	13.43	6.53	1.76	1.18	0.60	0.32	0.14

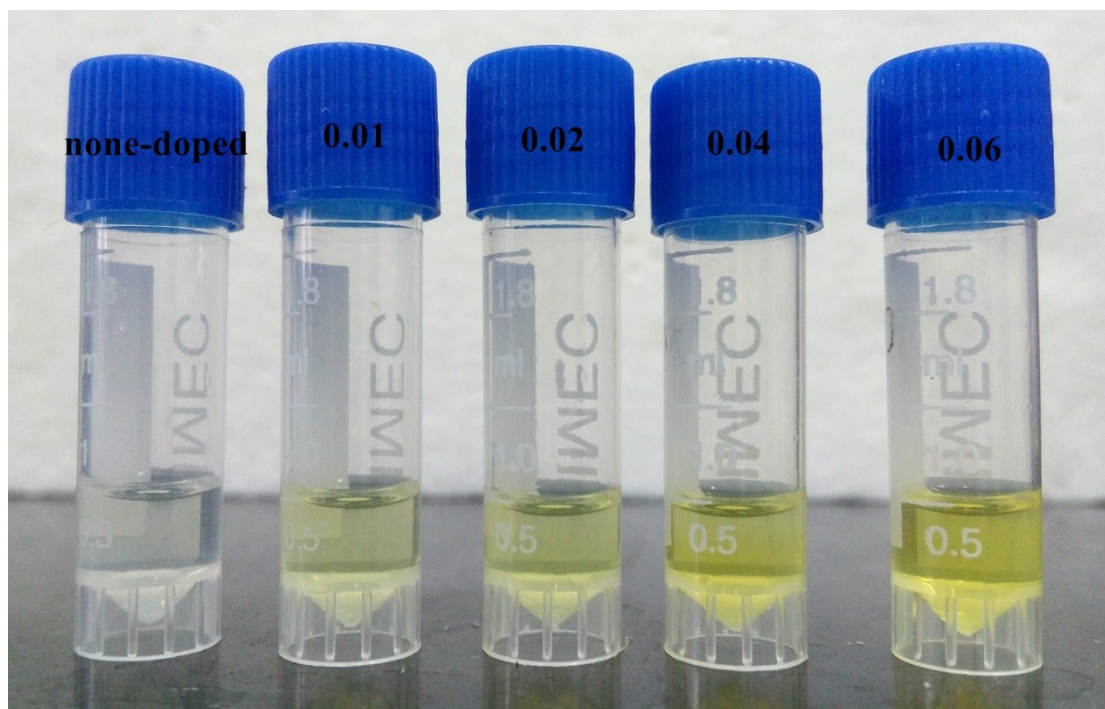


Figure S1. The Zn-Ti precursor solution photos of ETL at an increasing volume ratio of 0, 0.01, 0.02, 0.04, 0.06.

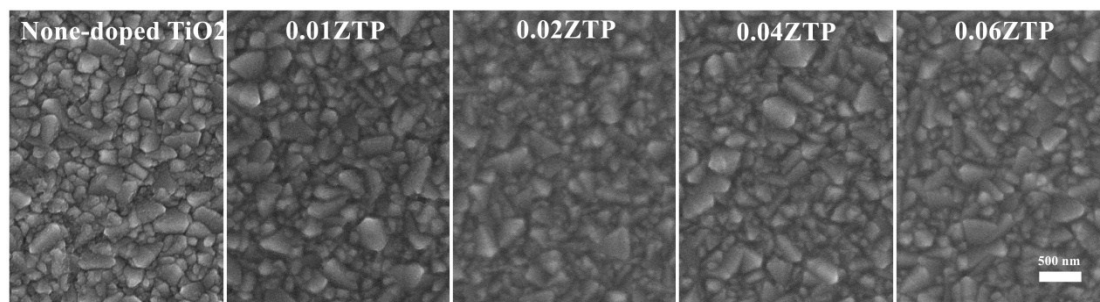


Figure S2. The SEM images of none-doped TiO_2 , 0.01ZTP, 0.02ZTP, 0.04ZTP and 0.06ZTP based ETL films.

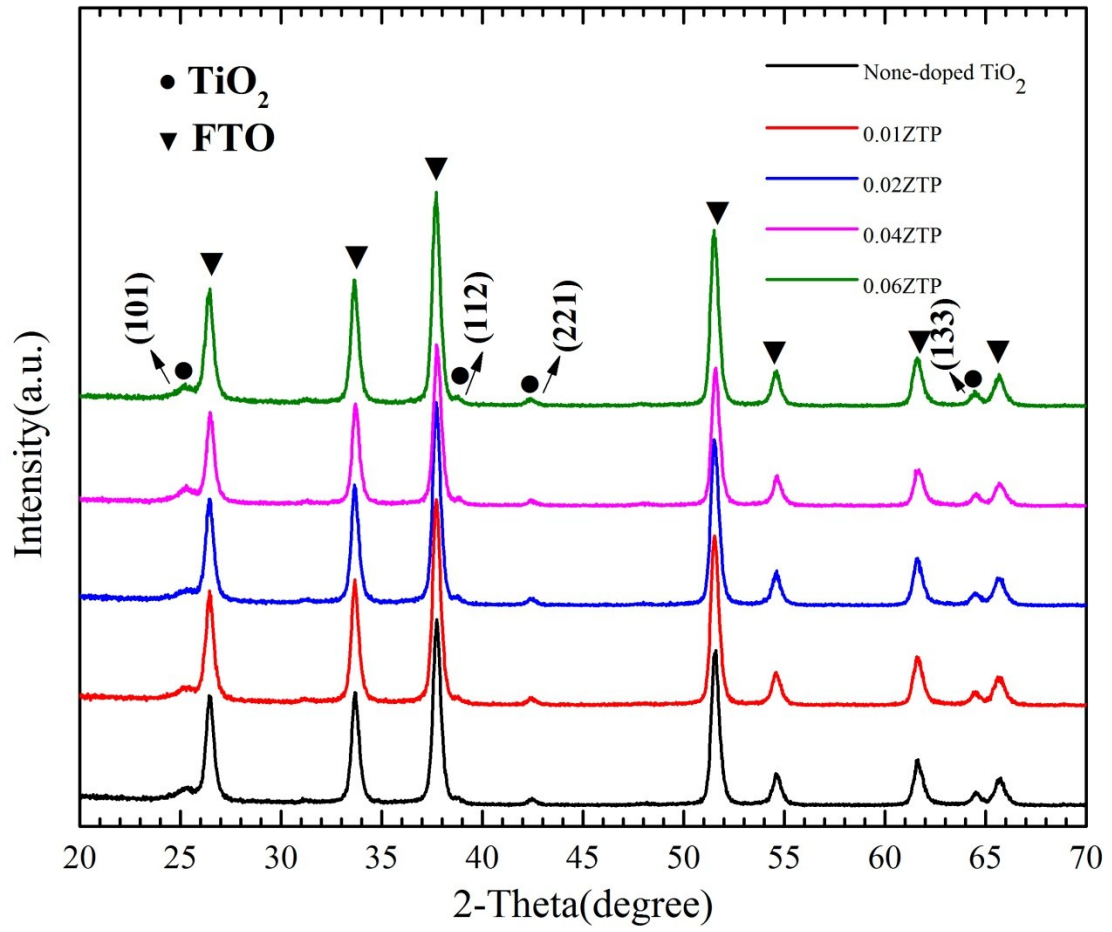


Figure S3. The XRD patterns of none-doped TiO₂, 0.01ZTP, 0.02ZTP, 0.04ZTP and 0.06ZTP based ETL films.

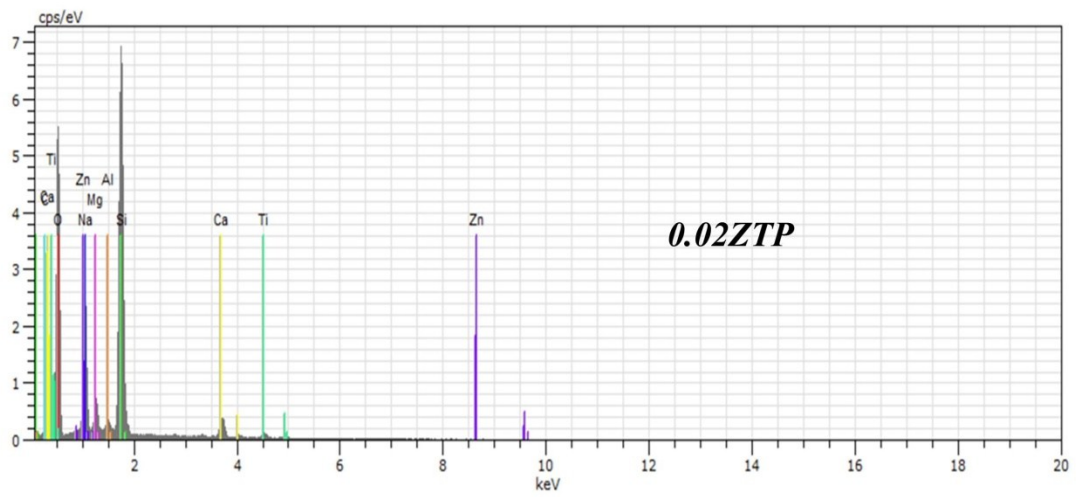
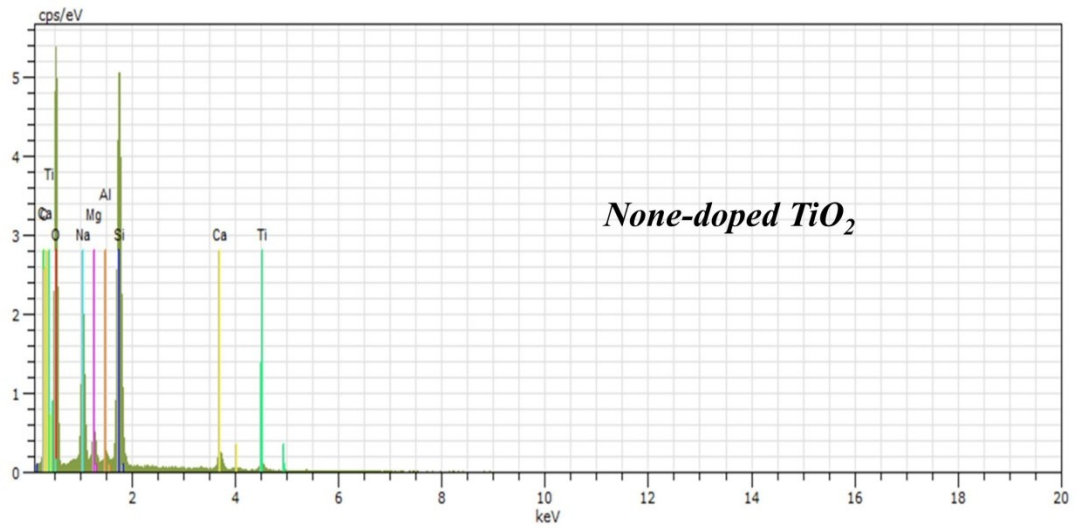


Figure S4. SEM-EDX spectrum for none-doped TiO₂ and 0.02ZTP compact layer on FTO glass.

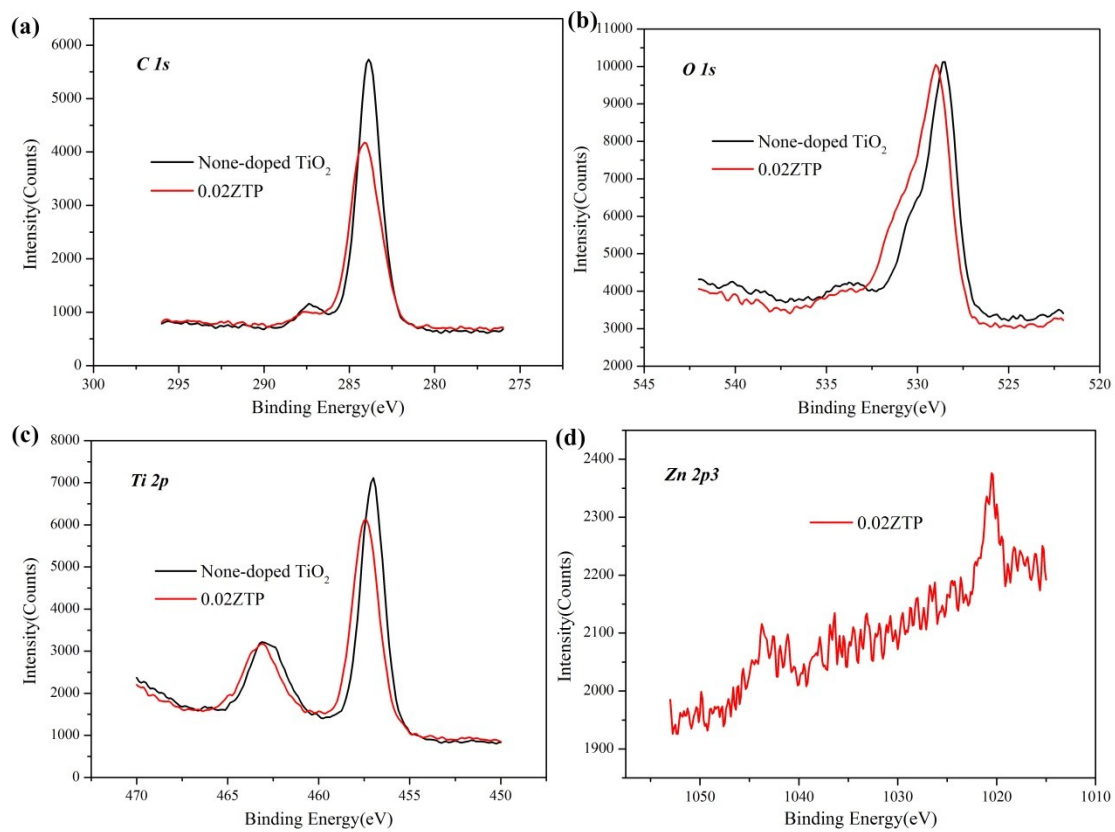


Figure S5. XPS spectra of none-doped TiO_2 and 0.02ZTP compact film: (a) C 1s, (b) O 1s, (c) Ti 2p, and (d) Zn 2p3.

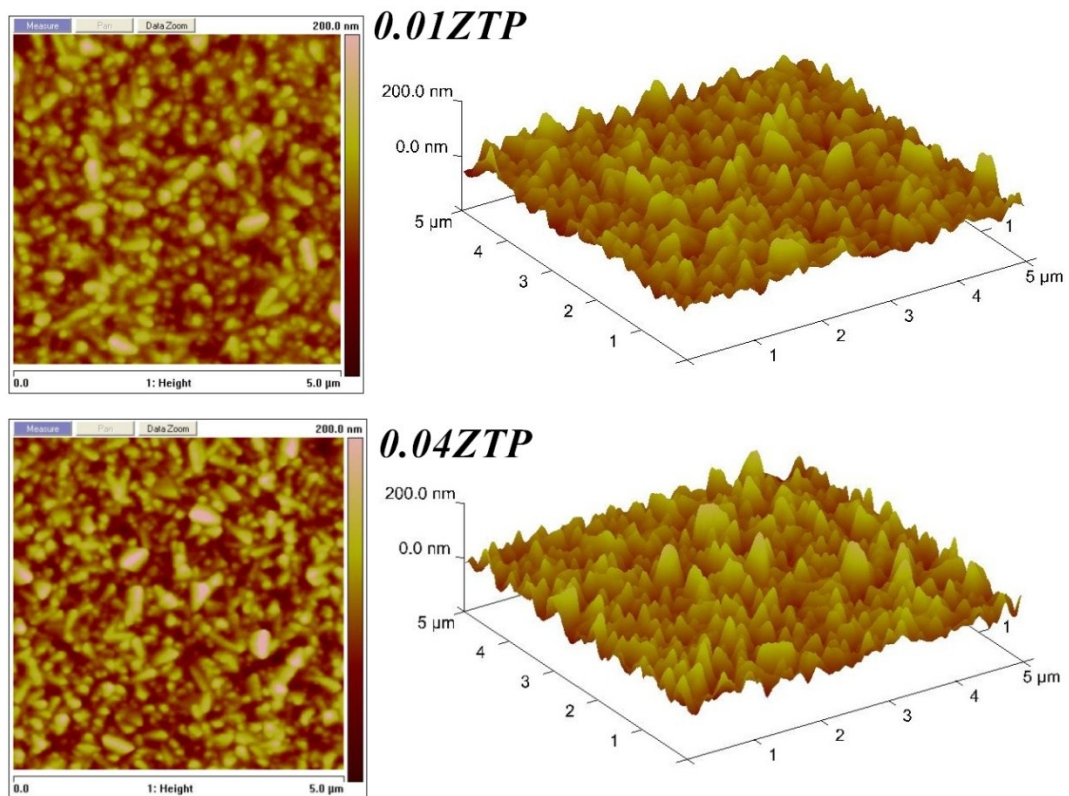


Figure S6. The atomic force microscopy (AFM) images of 0.01ZTP and 0.04ZTP based ETL films.

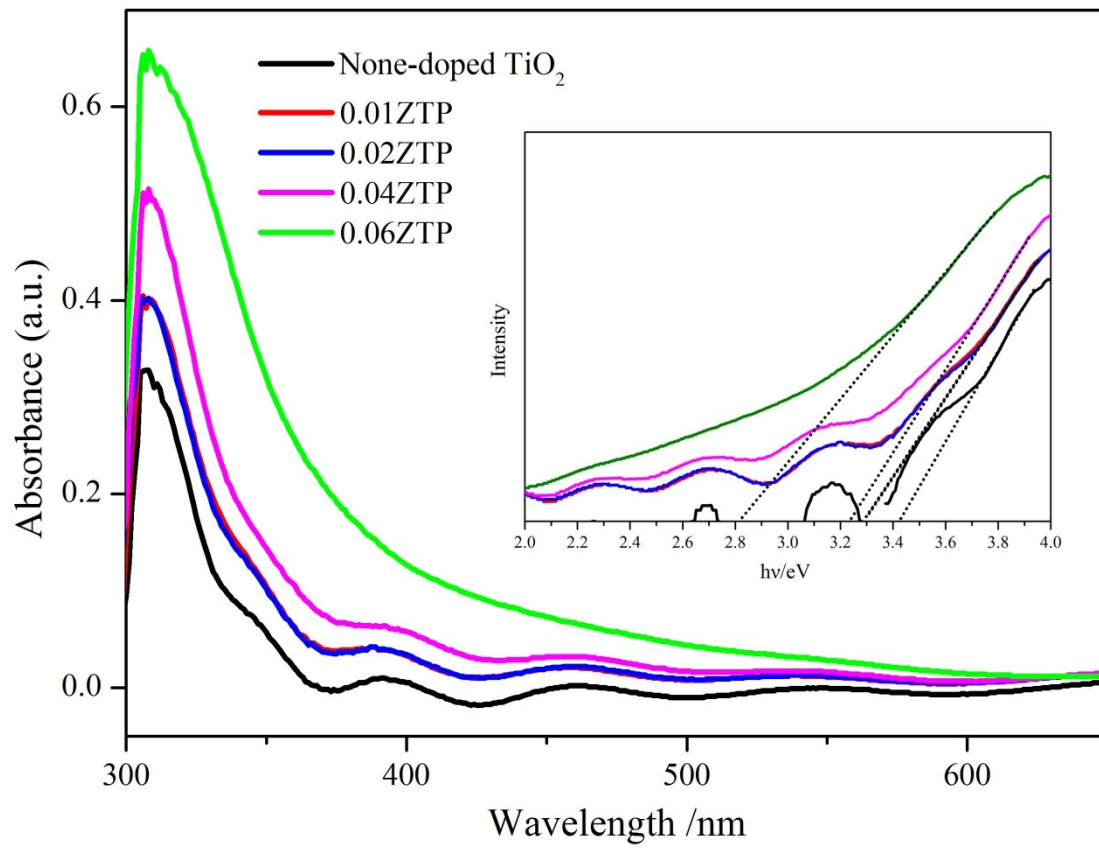


Figure S7. Absorption spectra of the none-doped TiO₂, 0.01ZTP, 0.02ZTP, 0.04ZTP and 0.06ZTP based ETL films.

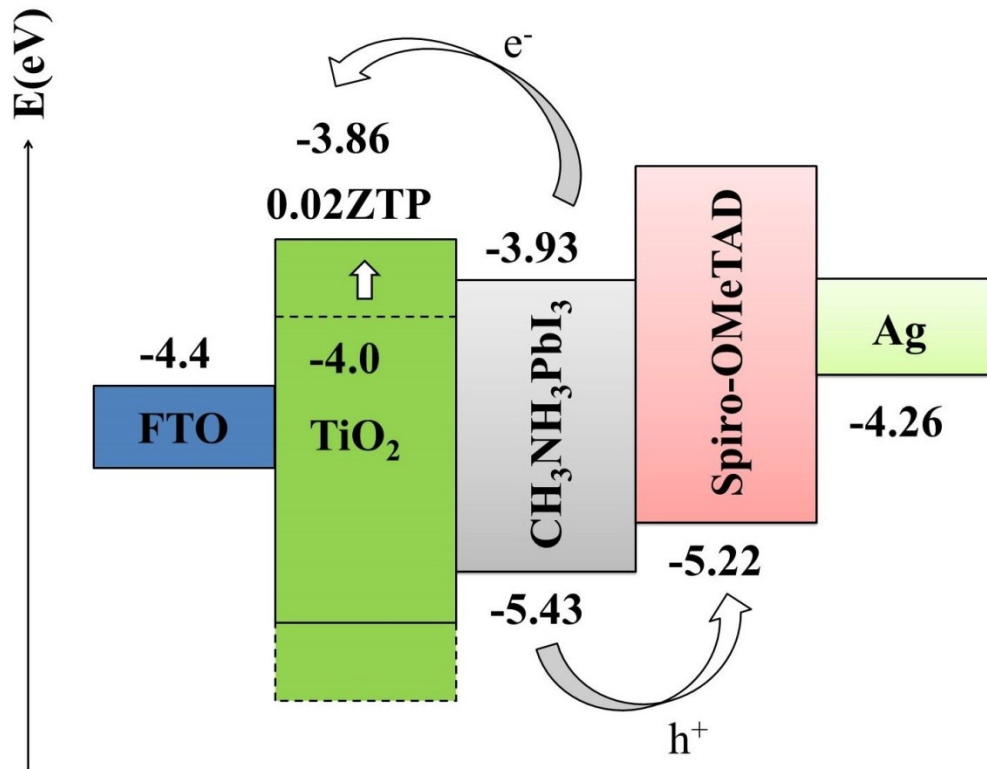


Figure S8. Energy level diagram of perovskite solar cells with none-doped TiO₂ and 0.02ZTP based ETL films.

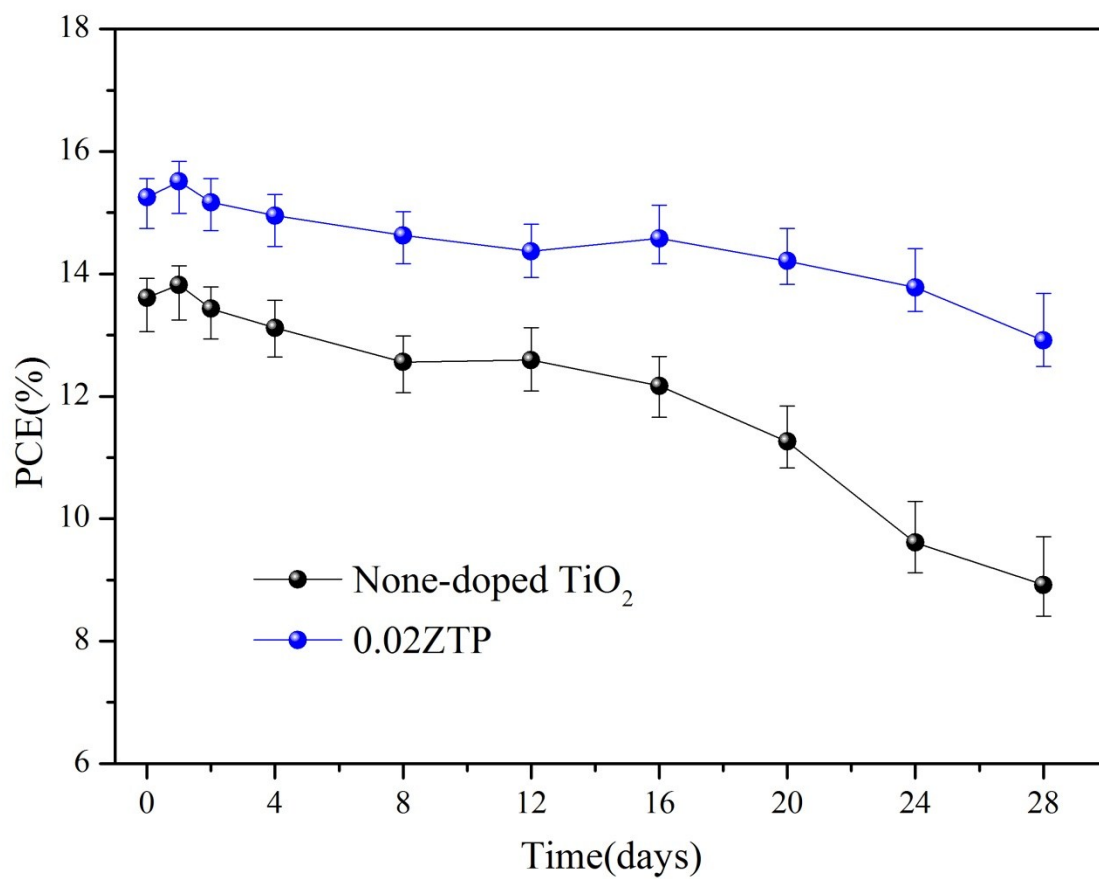


Figure S9. Long-term stability of PVSCs under a 35% humidity