

Supporting Information

Impact of inductive effect modulated built-in electric fields on performance of perovskite solar cells

Runtao Wang¹, Lin Xie^{1*}, Tai Wu¹ Chenghao Ge¹, Yong Hua^{1*}

¹ Yunnan Key Laboratory for Micro/Nano Materials & Technology, International
Joint Research Center for Optoelectronic and Energy Materials, School of Materials
and Energy, Yunnan University, Kunming 650091, Yunnan, P. R. China;

*Corresponding authors: l.xie@ynu.edu.cn, huayong@ynu.edu.cn

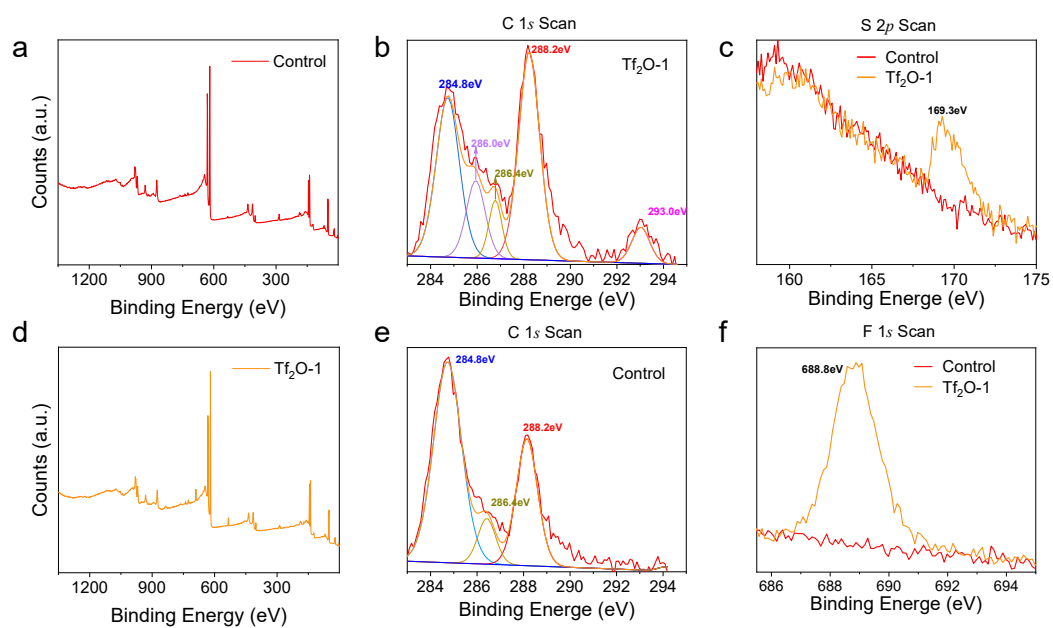


Figure S1. XPS spectrum of (a, d) complete spectrum, (b, e) $\text{C } 1s$, (c) $\text{S } 2p$, (f) $\text{F } 1s$ of control and $\text{Tf}_2\text{O}-1$ treated film.

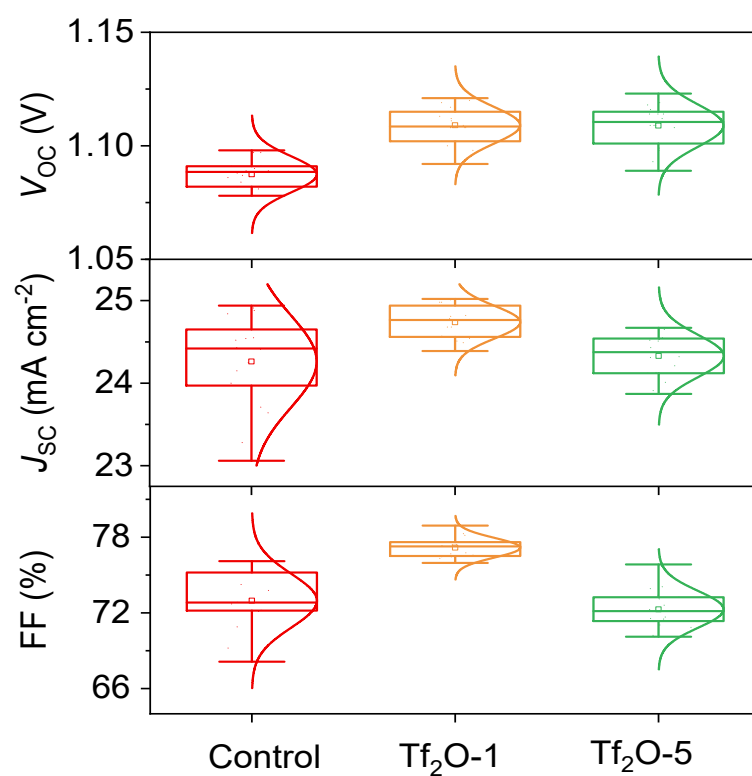


Figure S2. The corresponding photovoltaic parameters of V_{OC} , J_{SC} and FF of control, Tf₂O-1 and Tf₂O-5 modified devices (18 devices), respectively.

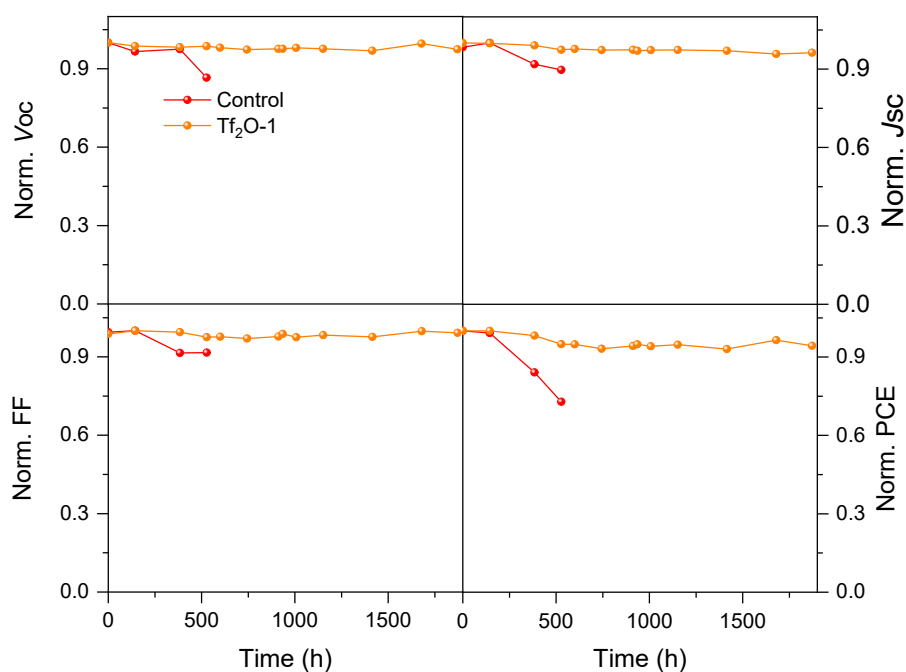


Fig. S3. The long-term stability of V_{OC} , J_{SC} , FF and PCE of the champion devices under natural environment (N₂ filled glovebox, T_≈25°C).

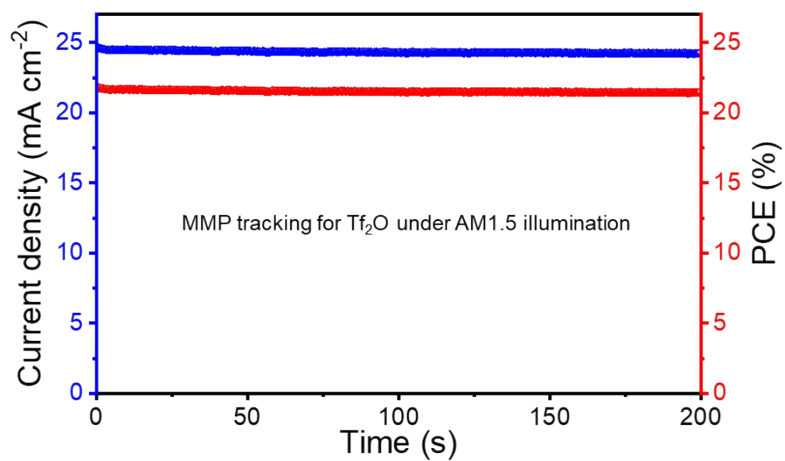


Fig. S4. Continuous maximum MPP tracking for 200 s of non-encapsulated Tf_2O -1 device under simulated AM 1.5 continuous illumination.

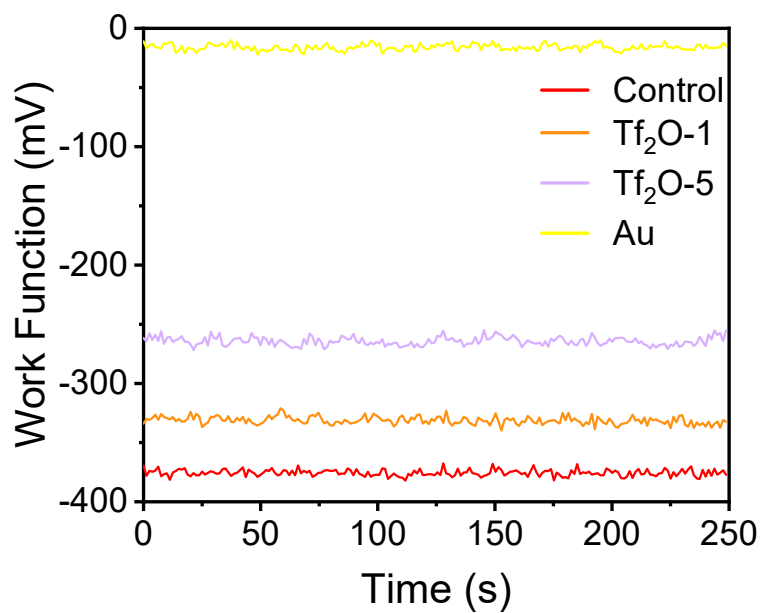


Fig. S5. Work function of Au, control, and Tf_2O -1, Tf_2O -5 treated perovskite films.

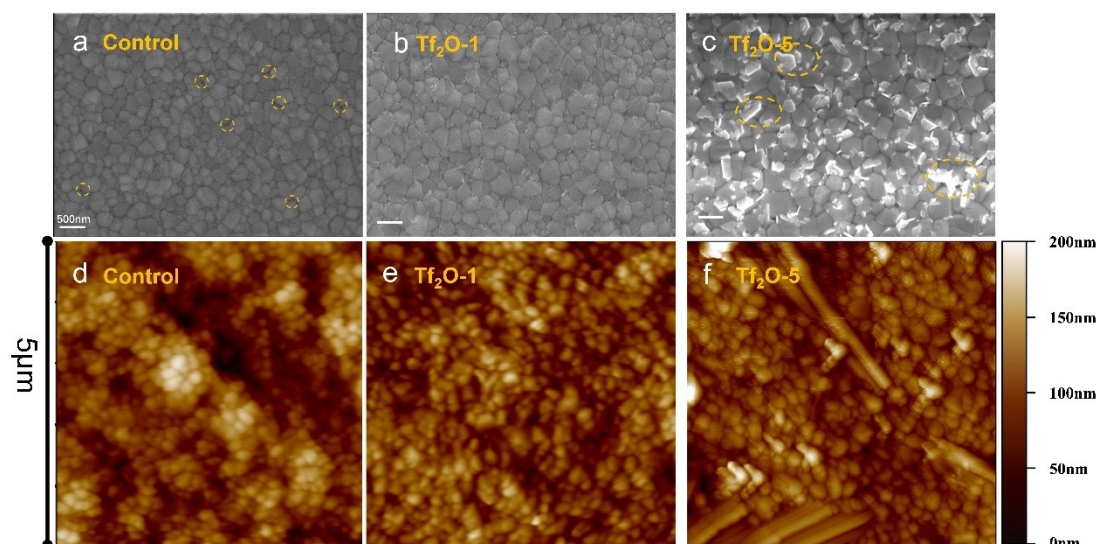


Fig. S6. (a-c) Top-view SEM and (d-f) AFM image of control, and $\text{Tf}_2\text{O-1}$, $\text{Tf}_2\text{O-5}$ treated films.

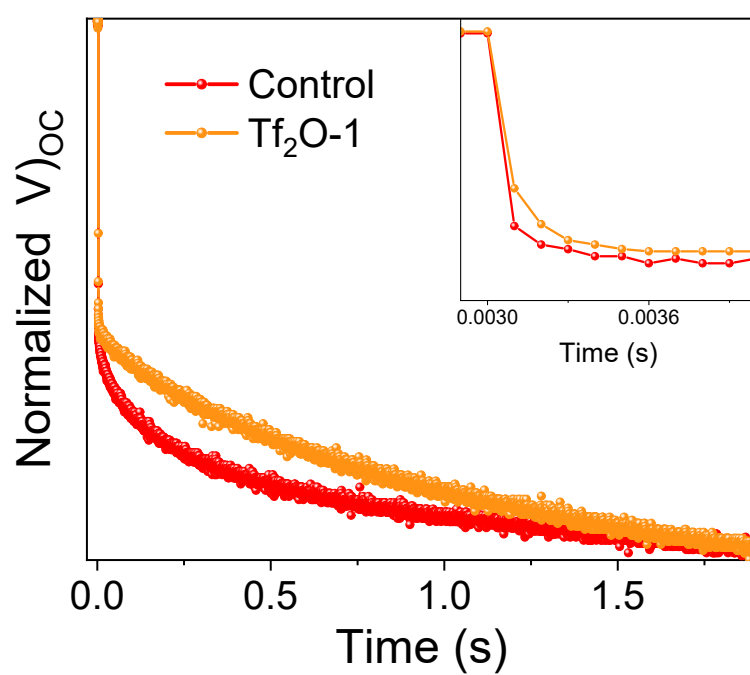


Fig. S7. TPV of control and $\text{Tf}_2\text{O-1}$ treated films.

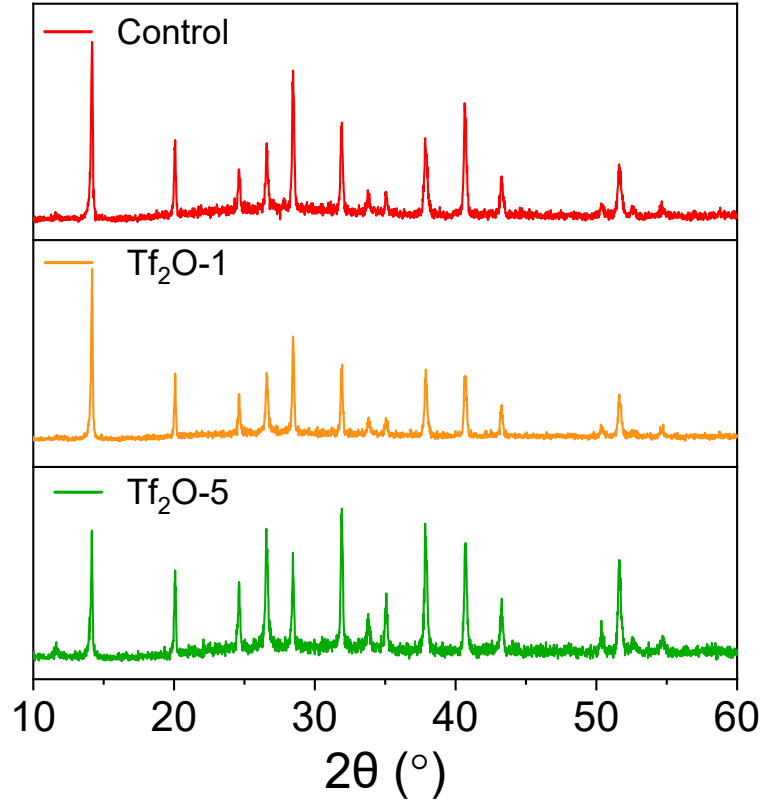


Fig. S8. XRD patterns of control, Tf₂O-1, and Tf₂O-5 films with the structure of FTO/TiO₂/perovskite/Tf₂O.

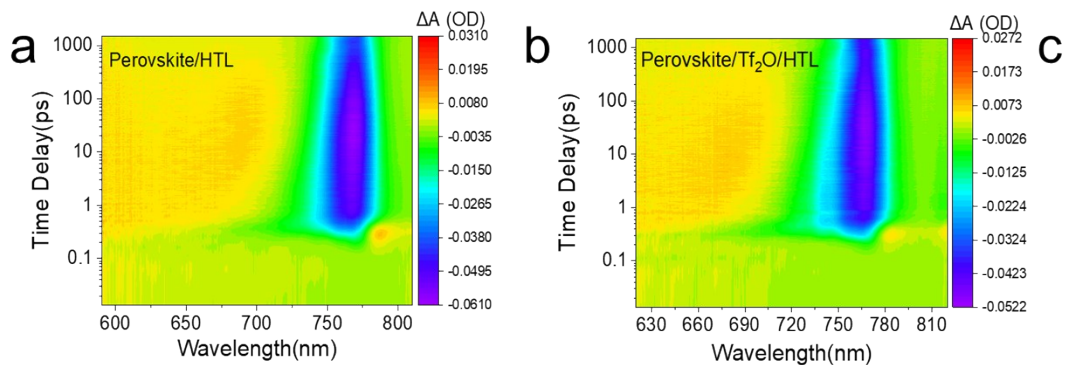


Fig. S9 The 2D color plot of TAS of (a) perovskite/HTL, (b) perovskite/Tf₂O/HTL

Table S1. The corresponding parameters of TRPL curves fitting by bi-exponential decay function.

	A_1	A_2	τ_1 (ns)	τ_2 (ns)	τ_a (ns)
Control	0.761	0.239	5.7	197.2	181.1
Tf ₂ O-1	0.475	0.523	3.5	591.0	587.9

Table S2. Fitted parameters of the corresponding kinetic traces of the photobleaching signals at 776 nm of different perovskite films with or without Tf₂O treatment.

	A_1	A_2	τ_1 (ns)	τ_2 (ns)	τ_a (ns)
FTO/ETL/Perovskite	0.863	0.136	306.4	2303.1	577.6
FTO/ETL/Perovskite/ Tf ₂ O	0.863	0.136	266.1	2102.5	515.6

Table S3. Fitted parameters of fs-TA for in perovskite/HTL films.

	A_1	A_2	A_3	τ_1 (ps)	τ_2 (ps)	τ_3 (ps)
Perovskite/HTL	1.53	0.48	0.58	0.06	1.7	13.9
Perovskite/Tf ₂ O/HTL	5.72	0.64	0.60	0.10	0.7	10.9