

Supplementary Information for  
**Efficient and stable perovskite solar cells via surface defect passivation  
using 4-fluorobenzamine trifluoroacetate**

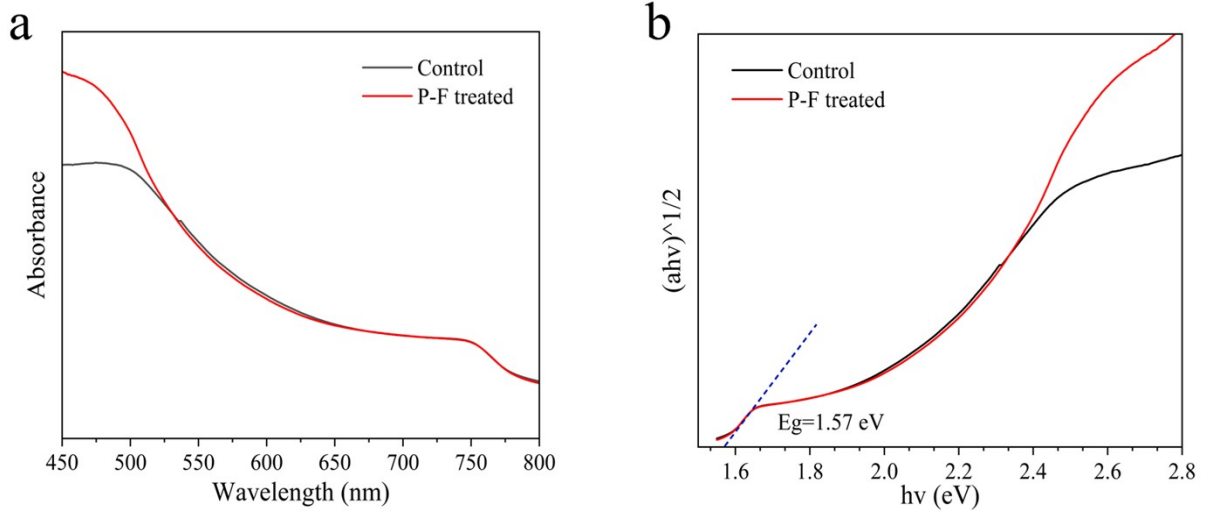
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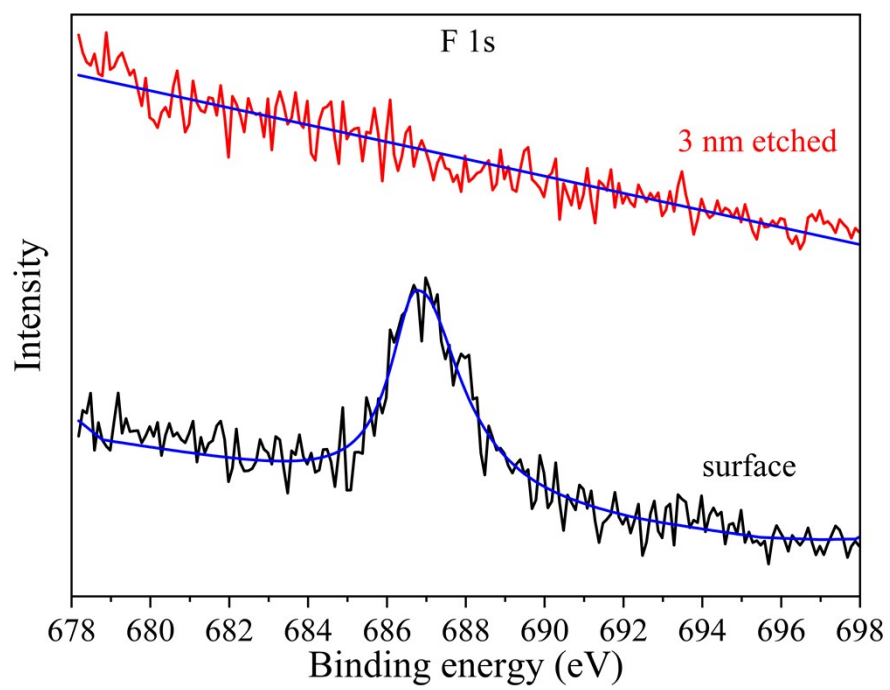
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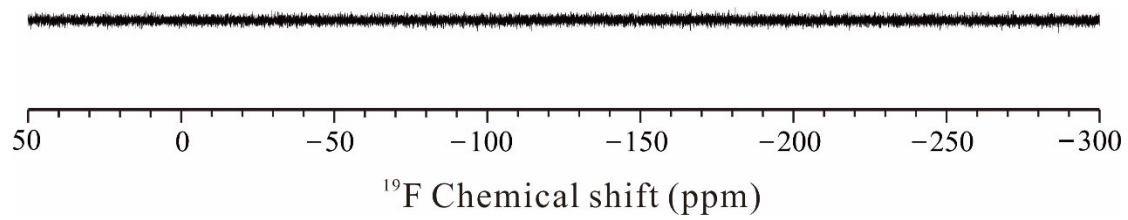
**E-mail: hwqiao@phy.ecnu.edu.cn, yfyao@phy.ecnu.edu.cn**



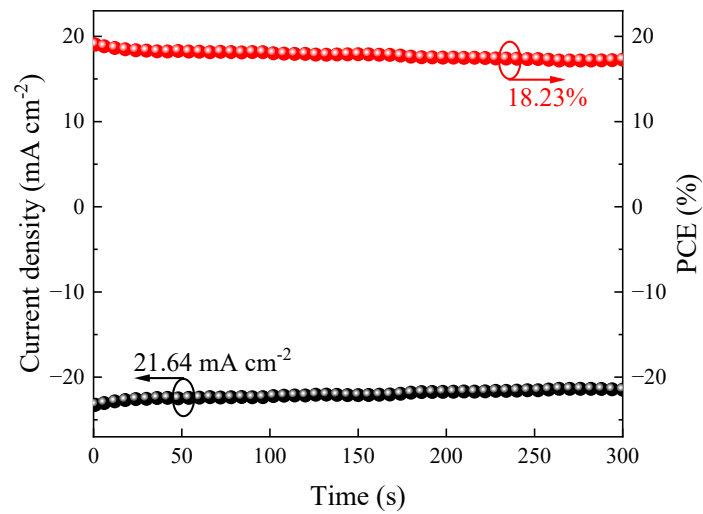
**Fig. S1.** (a) UV-vis absorption spectra of MAPbI<sub>3</sub> films without and with P-F treatment. (b) The corresponding Tauc spectra.



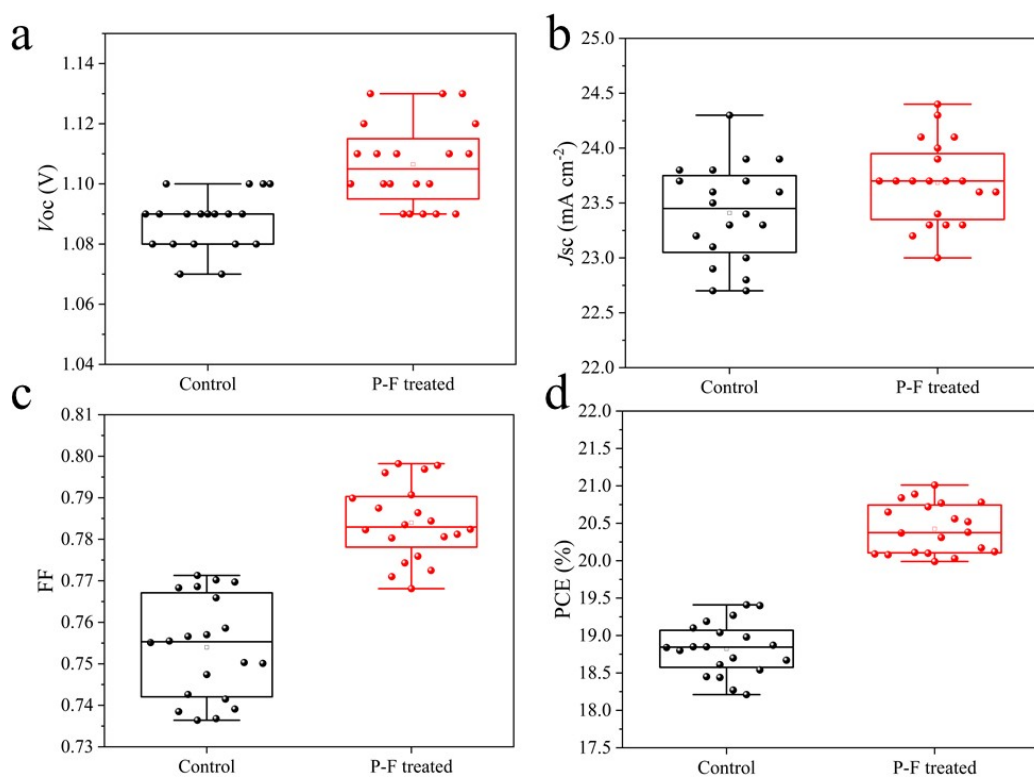
**Fig. S2.** Deep XPS etching of MAPbI<sub>3</sub> films on F 1s after P-F treatment.



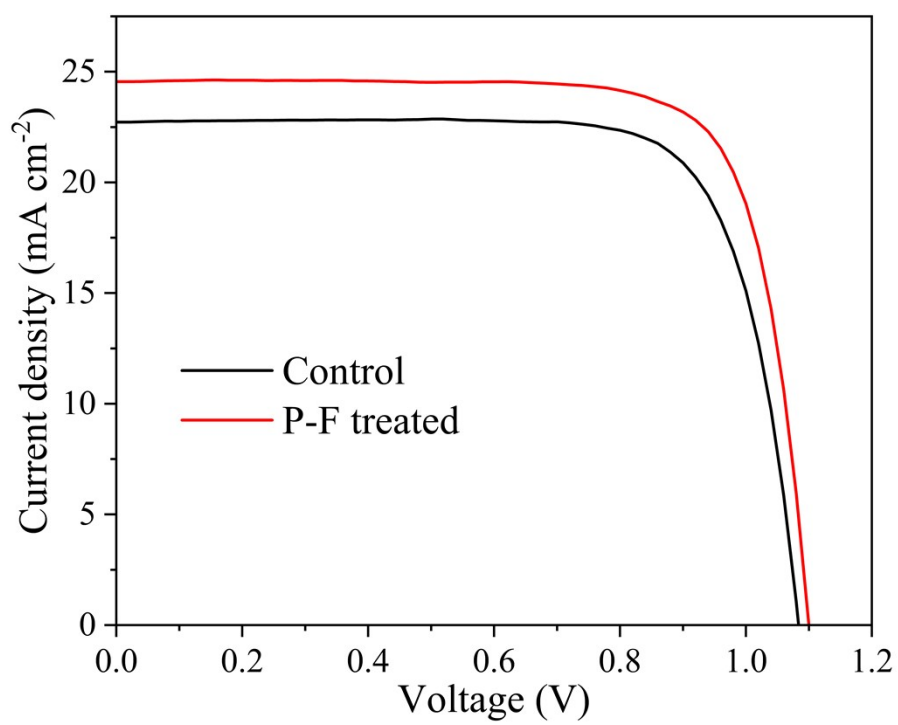
**Fig. S3.** Solid  $^{19}\text{F}$  NMR spectra of pure  $\text{MAPbI}_3$  powders.



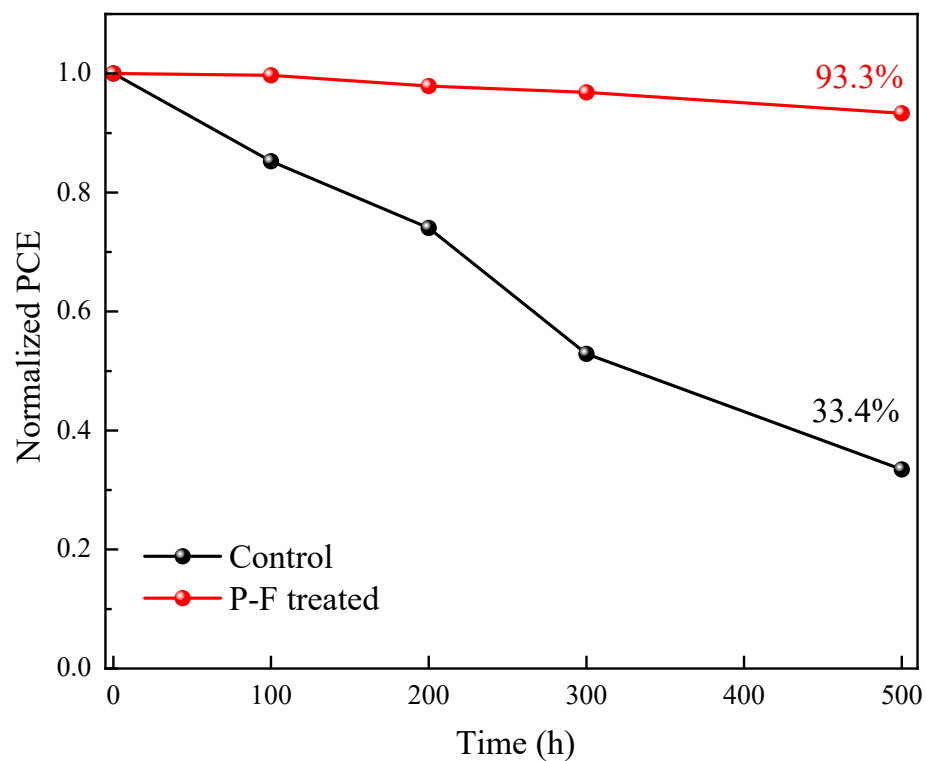
**Fig. S4.** Steady-state photocurrent density and power output at the maximal power point for control PSCs.



**Fig. S5.** Statistics of the photovoltaic parameters for the control (black) and P-F-PMATFA treated devices (red), showing the difference in  $V_{oc}$  (a),  $J_{sc}$  (b), FF (c), and PCE (d).

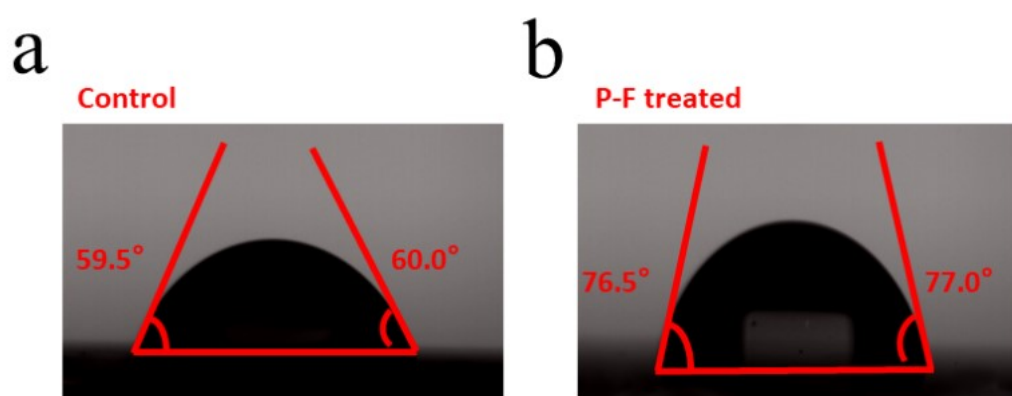


**Fig. S6.** The initial efficiency of unpackaged PSCs stability without P-F and with P-F treated.

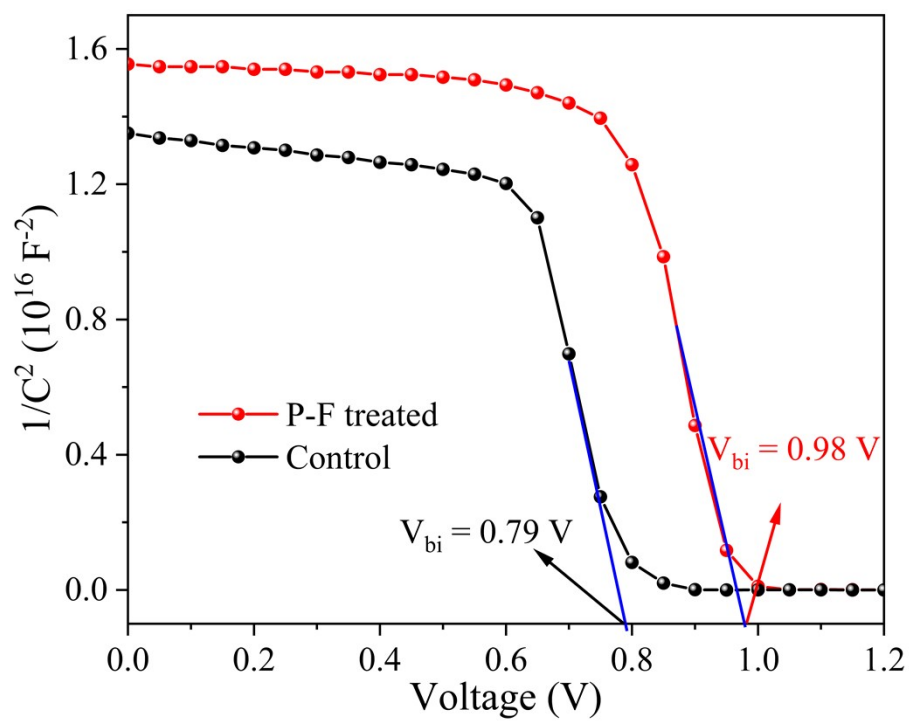


**Fig. S7.** Light stability of unencapsulated devices under continuous 1-sun equivalent illumination in a nitrogen atmosphere.





**Fig. S8.** (a,b) The water contact angle of perovskite films treated without and with P-F-PMATFA.



**Fig. S9.** The Mott-Schottky curve of the control and the P-F treated PSCs.

**Table S1.** The fitting results of the equivalent circuit of Nyquist plots.

Devices	$R_s$ ( $\Omega$ )	$R_{rec}$ ( $k\Omega$ )	$C_{rec}$ (nF)
Control	37.77	0.806	0.503
P-F treated	42.89	2.291	0.620