

Supporting Information

Improving the photovoltaic performance of planar heterojunction perovskite solar cells by mixed solvent vapor treatment

Binbin Yuan,^{a,b} Suling Zhao,^{*,a,b} Zheng Xu,^{a,b} Dandan Song,^{a,b} Bo Qiao,^{a,b} Yang Li,^{a,b}

Zilun Qin,^{a,b} Juan Meng,^{a,b} and Xurong Xu^{a,b}

^a Key Laboratory of Luminescence and Optical Information (Beijing Jiaotong University), Ministry of Education, Beijing 100044, China

^b Institute of Optoelectronics Technology, Beijing Jiaotong University, Beijing 100044, China

*: Corresponding Author

E-mail: slzhao@bjtu.edu.cn

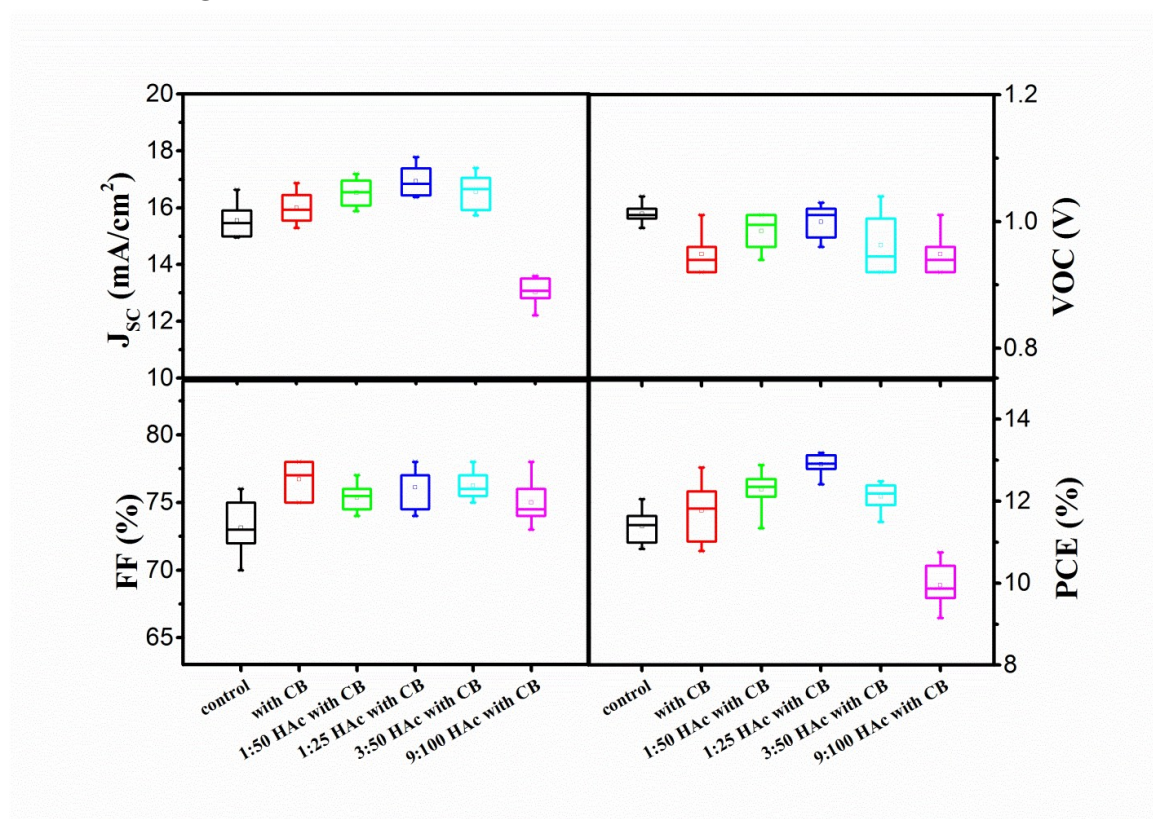


Fig. S1 Statistical data of photovoltaic parameters comparison about MAPbI₃ film were treated without and with various volume ratios HAC/CB.

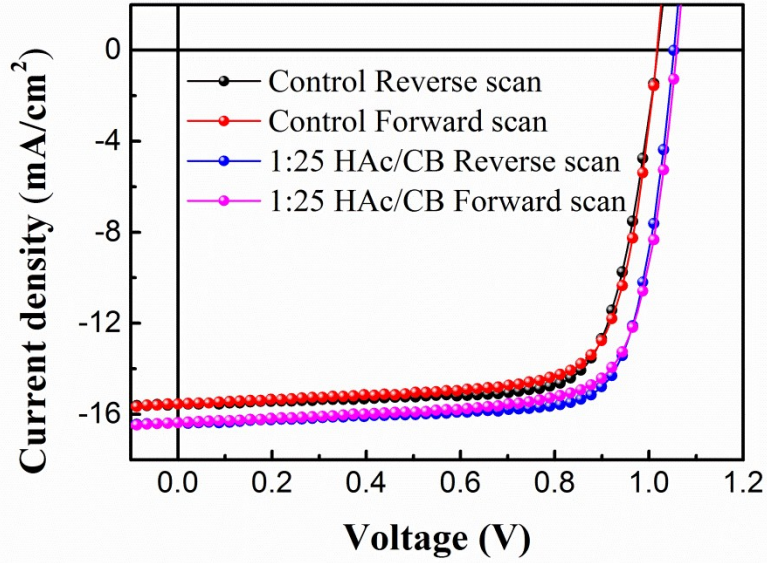


Fig. S2 The J-V characteristic of PSCs obtained by sweeping the voltage from forward to reverse and from reverse to forward bias with different treatment.

Table S1 Photovoltaic properties of PSCs extracted from Figure S2.

Annealing parameters	Scan direction	Jsc(mA/cm ²)	Voc(V)	FF(%)	PCE(%)
Control	Reverse	15.53	1.02	76	12.05
	Forward	15.57	1.02	74	11.80
1:25 HAc/CB	Reverse	16.35	1.04	77	13.15
	Forward	16.38	1.05	74	12.87

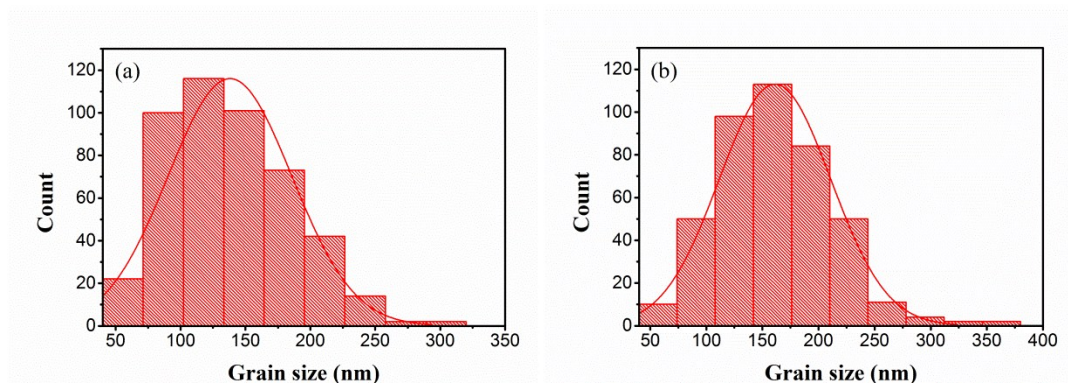


Fig. S3 The histograms of perovskite grain size (a) and (b) were on ITO/glass by counting the nano measurer software. MAPbI₃ films were treated without and with 1/25 volume ratios HAc/CB, respectively.

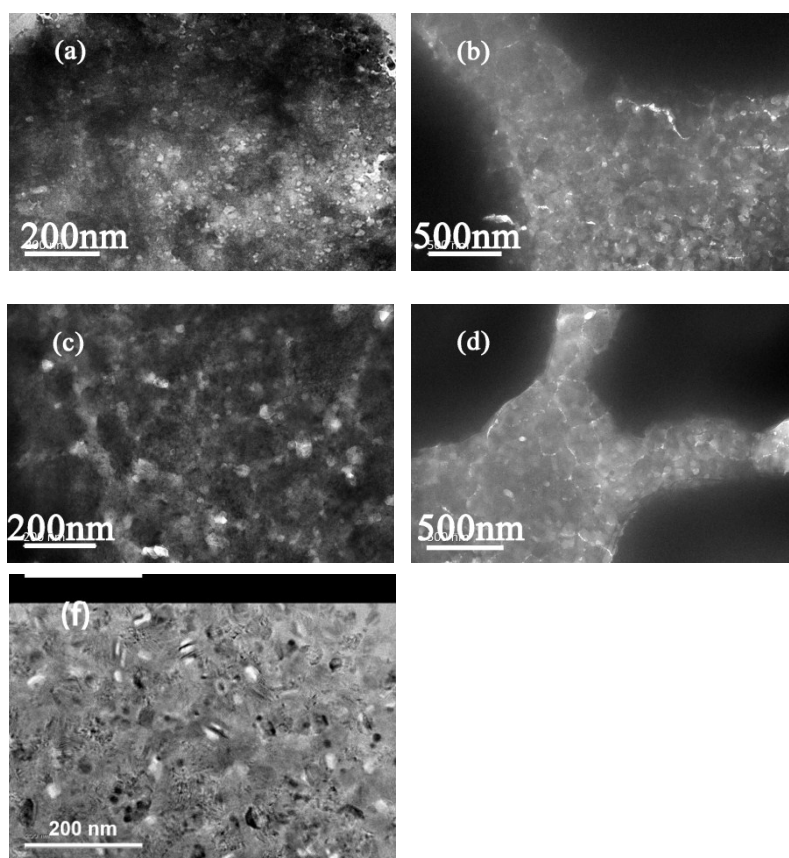


Fig. S4 The HRTEM figures of perovskite thin film (a), (b), (c), (d), (f) were on carbon-film-coated TEM grid. (a) and (b) MAPbI₃ films were treated without HAC/CB; (c) and (d) MAPbI₃ films were treated with 1/25 volume ratios HAC/CB; (f) TEM image of perovskite thin film was reported by others in reference 1.

The efficacy of this TEM-specimen preparation method has been confirmed in previous studies.¹⁻³ MAPbI₃ Perovskite films directly deposited on the TEM grid show much smaller grain size and multiple layers of grains,¹ It is notoriously difficult to distinguish clearly grain boundaries.

1. F. Ji, S. Pang, L. Zhang, Y. Zong, G. Cui, N. P. Padture and Y. Zhou, *ACS Energy Letters*, 2017, **2**, 2727-2733.
2. M. U. Rothmann, W. Li, Y. Zhu, U. Bach, L. Spiccia, J. Etheridge and Y.-B. Cheng, *Nature communications*, 2017, **8**, 14547.
3. Y. Zhou, A. L. Vasiliev, W. Wu, M. Yang, S. Pang, K. Zhu and N. P. Padture, *The journal of physical chemistry letters*, 2015, **6**, 2292-2297.