

Supplementary Information

Ligand Exchange Engineering of FAPbI₃ Perovskite Quantum Dots for Solar Cells

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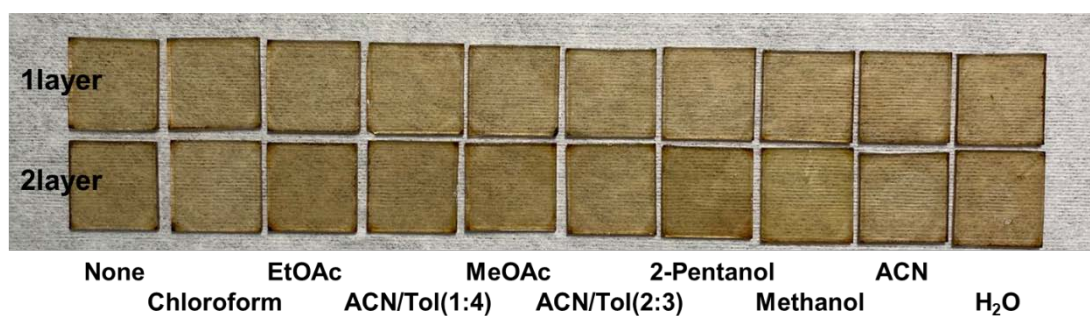


Fig. S1 Photograph of the FAPbI₃ PQD solid film with different anti-solvent treatments. The solid films in the 1st line are prepared with 1 layer of PQDs, and those in the 2nd are 2 layers of PQDs.

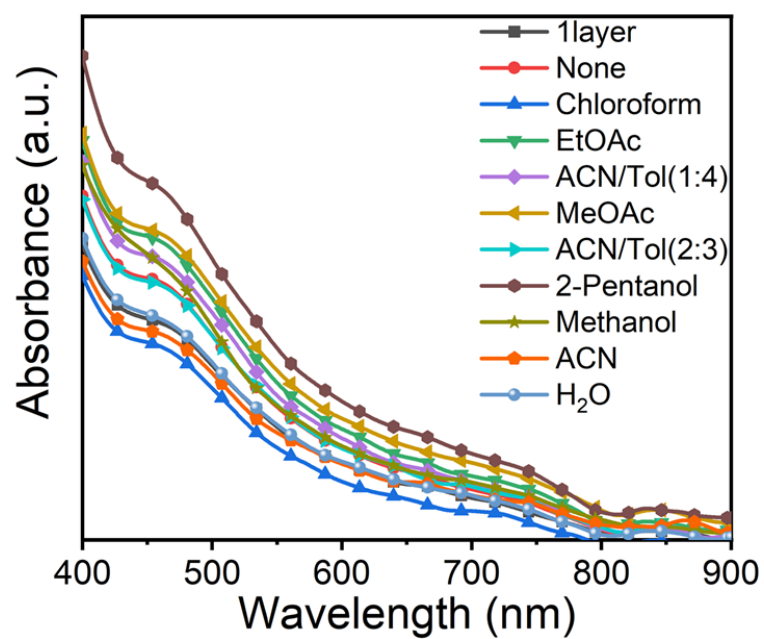


Fig. S2 UV-visible absorption spectra of the FAPbI₃ PQD solid films with different anti-solvent treatments.

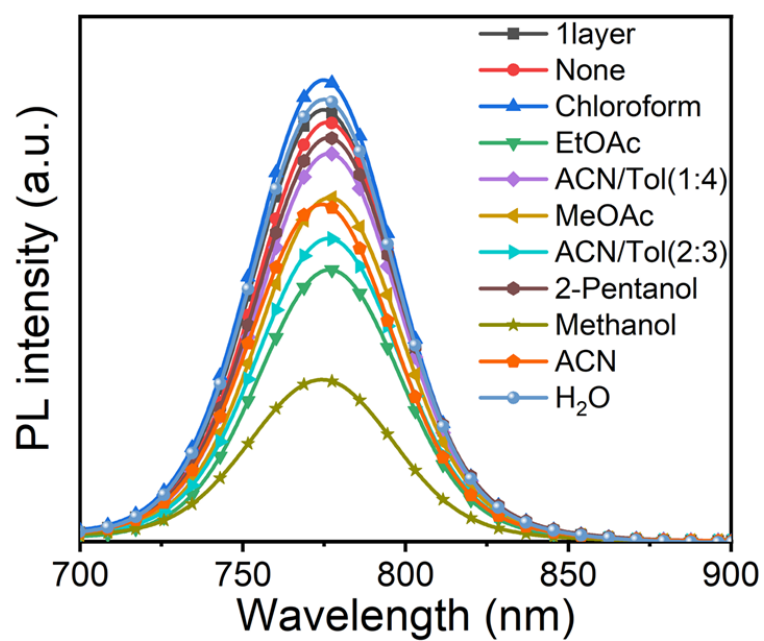


Fig. S3 PL spectra of the FAPbI₃ PQD solid films with different anti-solvent treatments.

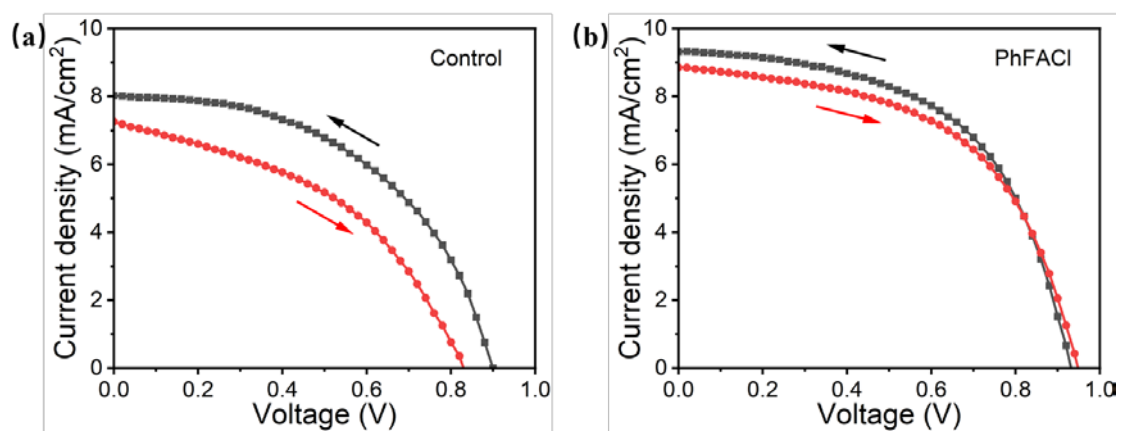


Fig. S4 *J*-*V* curves of conventional and PhFACl-based PQDSCs under reverse and forward voltage scanning directions.

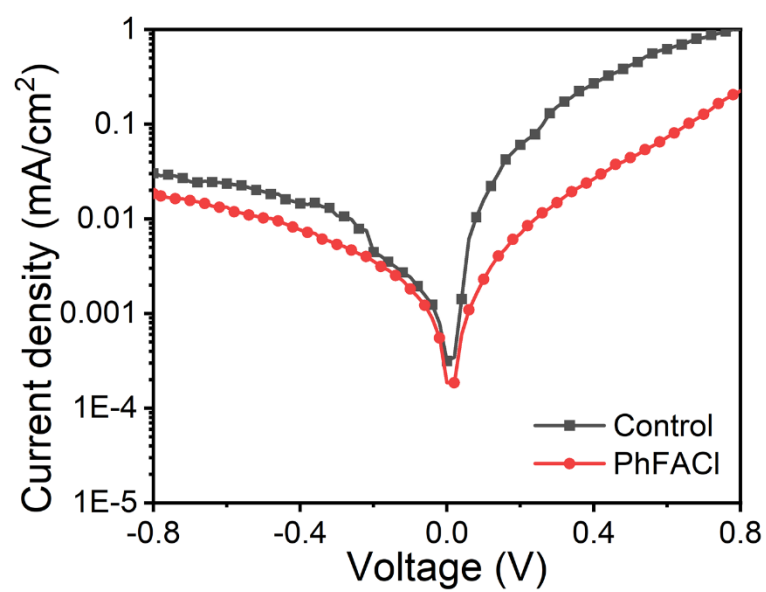


Fig. S5 Dark J - V curves of conventional and PhFACl-based PQDSCs.

Table S1. Summary of anti-solvent relative polarity. The relative polarity of mixed solvent was determined from the arithmetic average of the solvent volume ratios.^[1]

Name	Relative polarity	Name	Relative polarity
ACN/toluene (v:v 1:4)	0.171	EtOAc	0.228
ACN/toluene (v:v 2:3)	0.243	Chloroform	0.259
MeOAc	0.287	ACN	0.46
2-pentanol	0.488	Methanol	0.762
H ₂ O	1		

Table S2. Fitting parameters of the TPV curves of conventional and PhFACl-based PQDSCs.

Parameter	Control	PhFACl
A	0.49	0.17
$\tau_1(\text{ms})$	0.44	0.34
B	0.22	0.53
$\tau_2(\text{ms})$	2.80	5.43
C	0.04	0.21
$\tau_{\text{ave}}(\text{ms})$	2.18	5.34

The data of the TPV measurement is fitted using the following equation:

$$V_{oc} = A \exp\left(-\frac{t}{\tau_1}\right) + B \exp\left(-\frac{t}{\tau_2}\right) + C$$

where t is the decay time, τ_1 and τ_2 are the decay lifetimes, and A , B , and C are constants.

The average lifetime, τ_{ave} , is calculated using the following equation:

$$\tau_{\text{ave}} = \frac{A\tau_1^2 + B\tau_2^2}{A\tau_1 + B\tau_2}$$

Table S3. Fitting parameters of the TPC curves of conventional and PhFACl-based PQDSCs.

Parameter	Control	PhFACl
A	0.22	0.35
$\tau_T(\text{ms})$	40.5	23.5
B	0.005	0.006

The data of the TPC measurement is fitted using the following equation:

$$J_{sc} = A \exp\left(-\frac{t}{\tau_T}\right) + B$$

where t is the decay time, τ_T is the decay lifetime, and A and B are constants.

References

1. Xue, J., Lee, J.-W., Dai, Z., Wang, R., Nuryyeva, S., Liao, M.E., Chang, S.-Y., Meng, L., Meng, D., Sun, P., Lin, O., Goorsky, M.S., Yang, Y.: Surface Ligand Management for Stable FAPbI₃ Perovskite Quantum Dot Solar Cells. *Joule*. 2, 1866-78 (2018).
<http://dx.doi.org/10.1016/j.joule.2018.07.018>