

Supporting Information

Charge Compensating Defects in Methylammonium Lead Iodide Perovskite Suppressed by Formamidinium Inclusion

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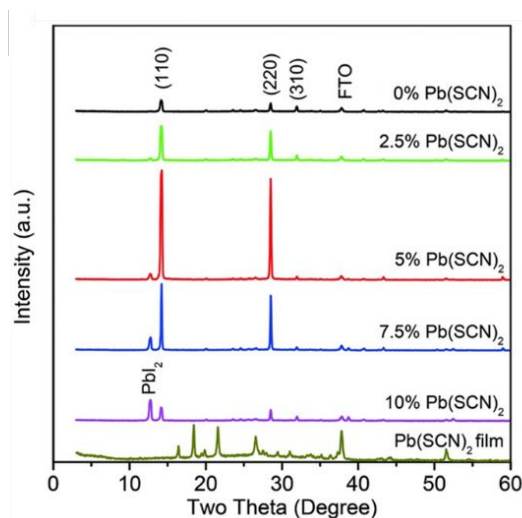


Figure S1. XRD patterns of $\text{Pb}(\text{SCN})_2$ film and MAPbI_3 films with various concentration of $\text{Pb}(\text{SCN})_2$ in the precursors coated on FTO substrates. Adapted from Ref. 1 with permission, copyright 2016Wiley-VCH.

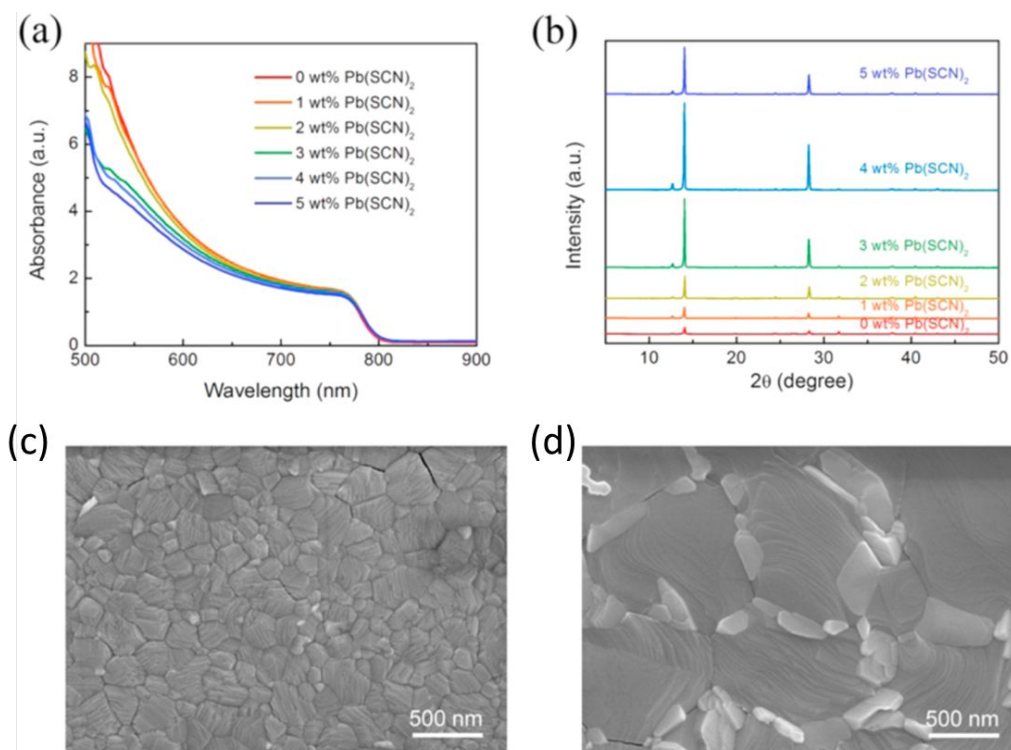


Figure S2. Characterizations of $\text{MA}_{0.7}\text{FA}_{0.3}\text{PbI}_3$ films with various content of $\text{Pb}(\text{SCN})_2$ additive. (a) UV-vis spectra, (b) XRD patterns of $\text{MA}_{0.7}\text{FA}_{0.3}\text{PbI}_3$ films with various content of $\text{Pb}(\text{SCN})_2$ additive. SEM images of (c) $\text{MA}_{0.7}\text{FA}_{0.3}\text{PbI}_3$ and (d) $\text{MA}_{0.7}\text{FA}_{0.3}\text{PbI}_3$ + 3 wt% $\text{Pb}(\text{SCN})_2$ films. Adapted from Ref. 2 with permission, copyright 2017 Elsevier.

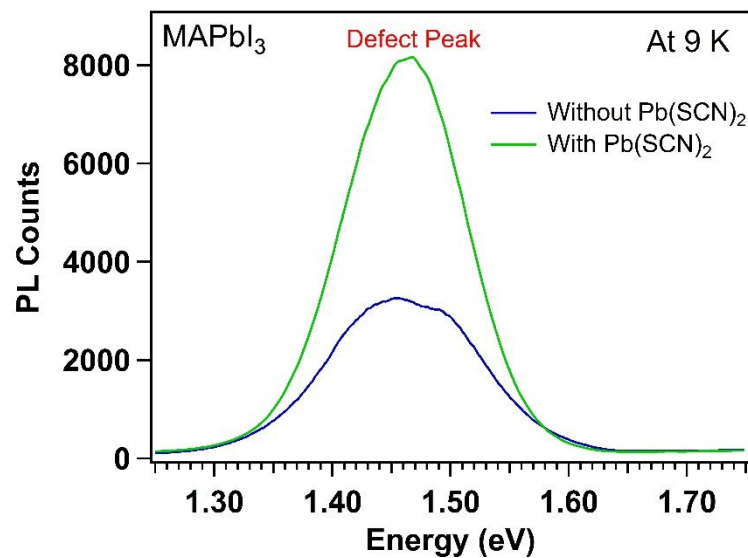


Figure S3. PL Spectra of MAPbI₃ films at 9 K with and without Pb(SCN)₂ additive.

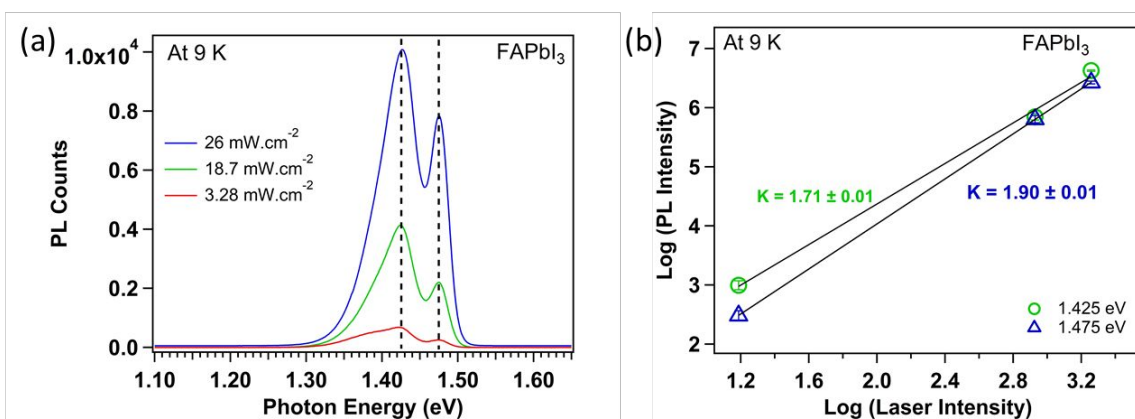


Figure S4. (a) PL spectra of FAPbI₃ at various laser intensities and (b) PL intensity vs. laser intensity.

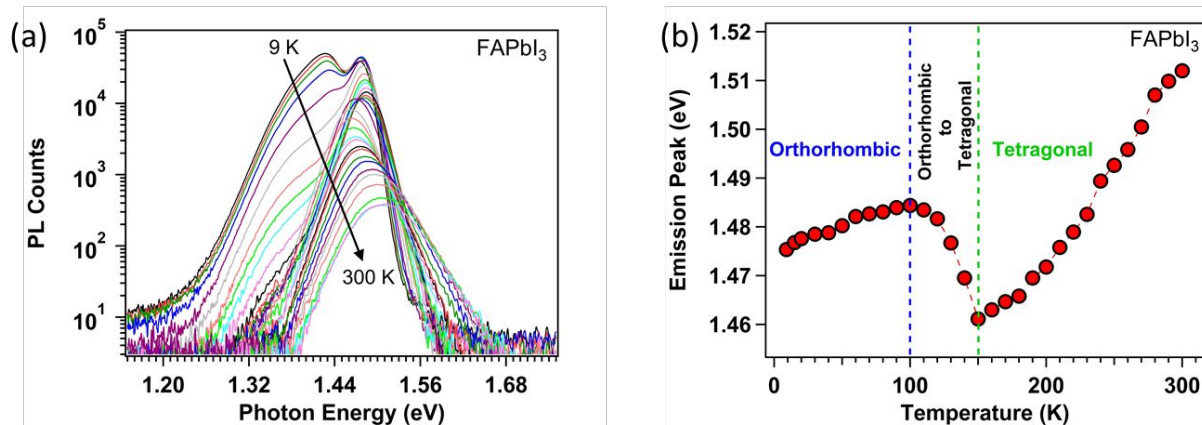


Figure S5. (a) Evolution of exciton peak of FAPbI₃ at various temperatures and (b) different phases in FAPbI₃ revealed by temperature dependent PL.

References

- (1) Ke, W.; Xiao, C.; Wang, C.; Saparov, B.; Duan, H.-S.; Zhao, D.; Xiao, Z.; Schulz, P.; Harvey, S. P.; Liao, W. *et. al*, Employing Lead Thiocyanate Additive to Reduce the Hysteresis and Boost the Fill Factor of Planar Perovskite Solar Cells. *Advanced Materials* **2016**, 28 (26), 5214-5221.
- (2) Wang, C.; Zhao, D.; Yu, Y.; Shrestha, N.; Grice, C. R.; Liao, W.; Cimaroli, A. J.; Chen, J.; Ellingson, R. J.; Zhao, X. *et. al*, Compositional and Morphological Engineering of Mixed Cation Perovskite Films for Highly Efficient Planar and Flexible Solar Cells with Reduced Hysteresis. *Nano Energy* **2017**, 35, 223-232.