Electronic Supplementary Material (ESI) for Nanoscale.

Solution-processed Highly Bright and Durable Cesium Lead Halide Perovskite Light-emitting Diodes

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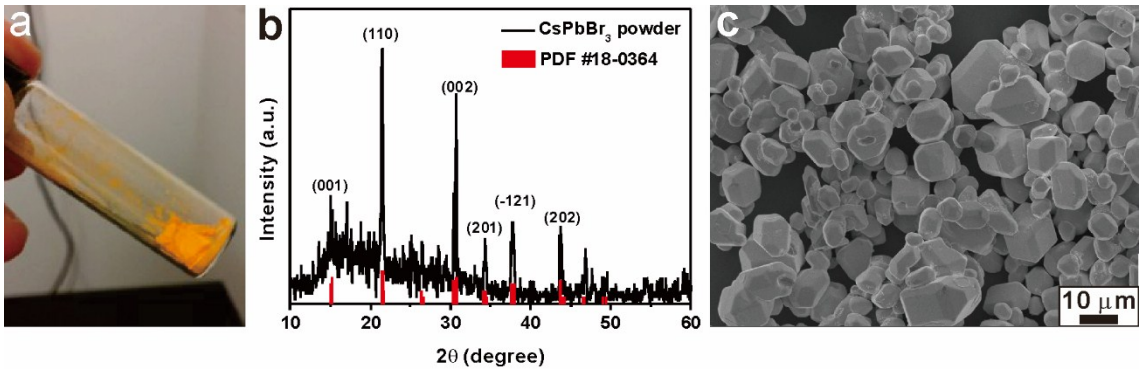

Figure S1. (a) Photograph, (b) XRD pattern and (c) SEM image of the as-prepared $CsPbBr_3$ powder.

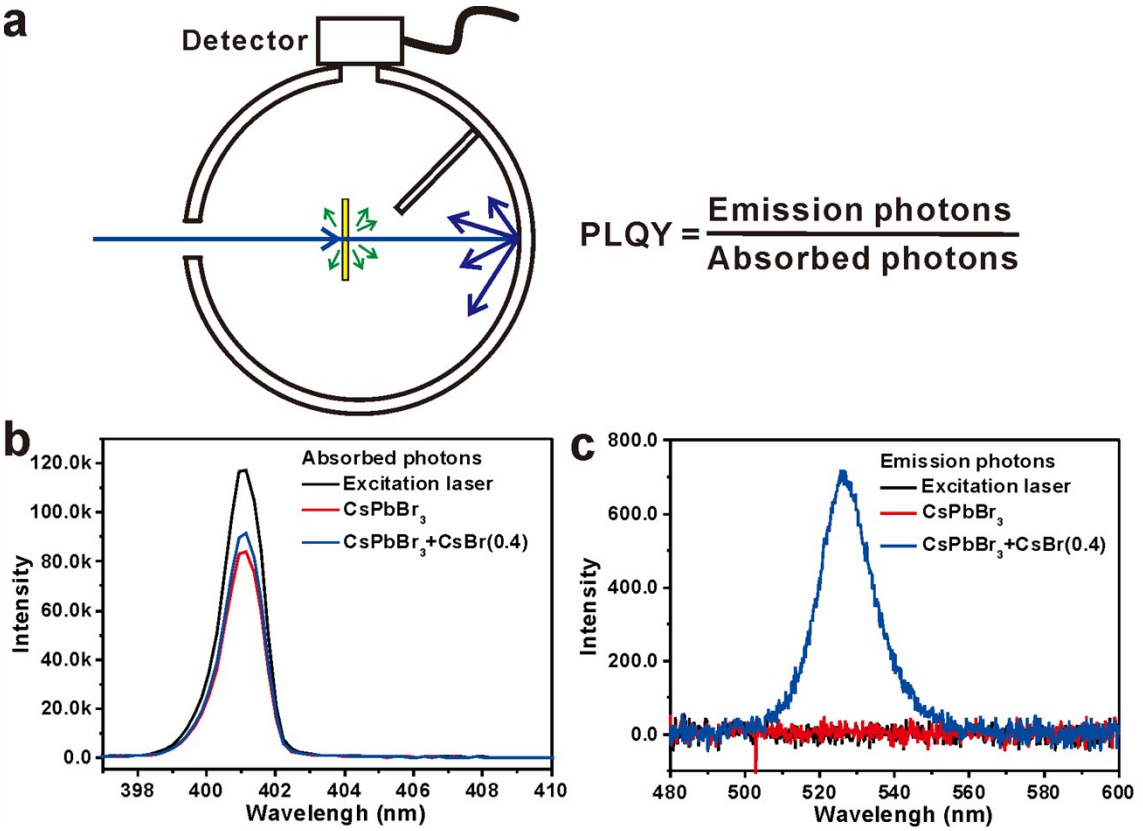

Figure S2. PLQY measurement of the as-deposited perovskite films. (a) Schematic diagram of the home-made apparatus for PLQY measurement. (b) Intensity spectra of the pristine excitation laser and lasers passing through $CsPbBr_3$ and $CsPbBr_3$+CsBr(0.4) thin films, where the absorbed photons number can be calculated by integrating area between curves. (c) Emission

spectra of the pristine excitation laser and $CsPbBr_3$ and $CsPbBr_3$+CsBr(0.4) thin films, where the emission photons number can be calculated by integrating area between curves. After calculation, it is determined that the PLQY of $CsPbBr_3$ and $CsPbBr_3$+CsBr(0.4) thin films are 0.5 % and 33.6 %, respectively.

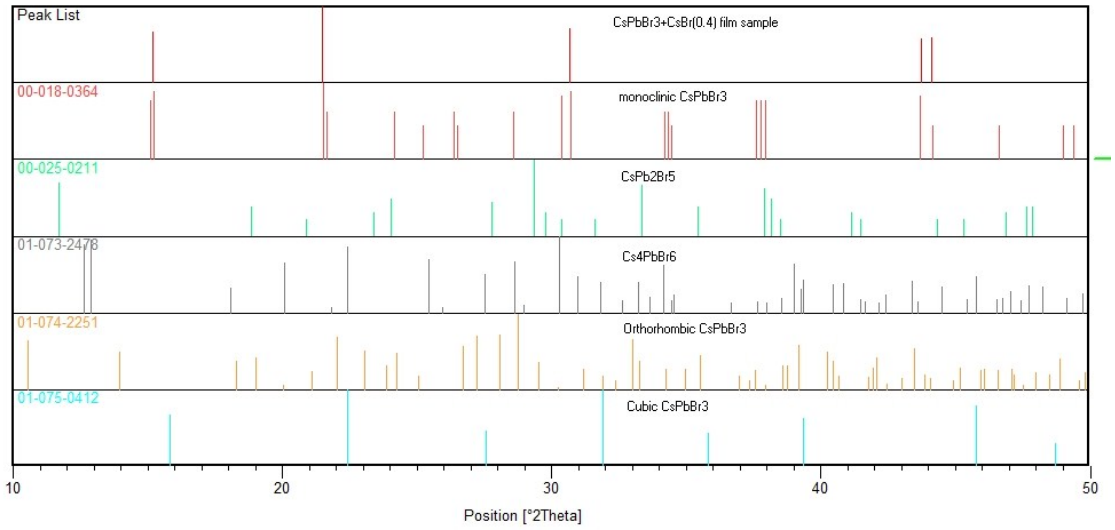

Figure S3. XRD analysis of the as-prepared $CsPbBr_3$+CsBr(0.4) films, from which we can conclude that the film is pure monoclinic phase by carefully comparing XRD data with other related standard diffraction patterns.

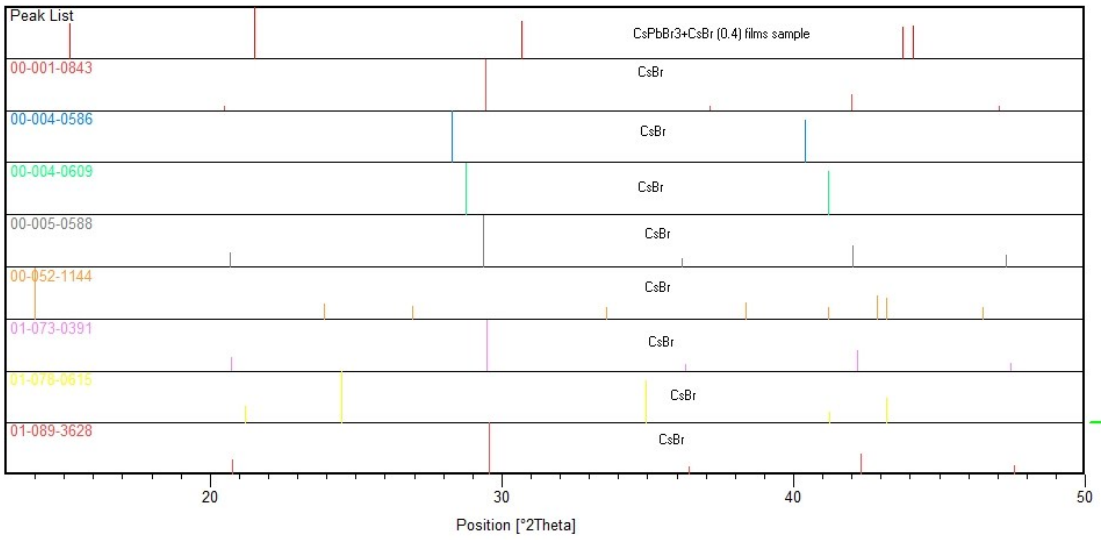

Figure S4. XRD analysis of the as-prepared $CsPbBr_3$+CsBr(0.4) films, from which we can conclude that there is not CsBr residues in the as-formed films by comparing the XRD data with all of the other standard diffraction patterns of CsBr.

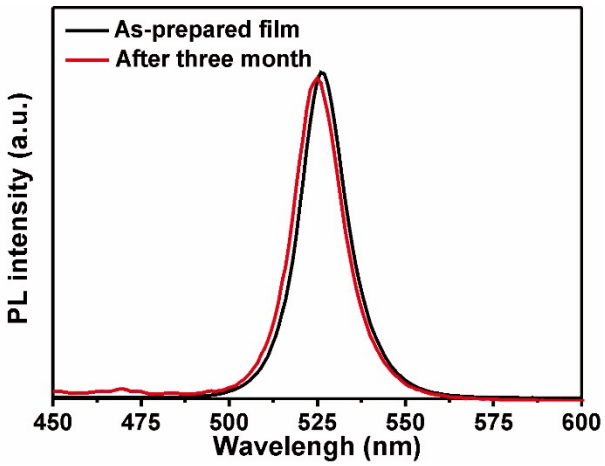

Figure S5. Outstanding PL stability of one as-deposited $CsPbBr_3$+CsBr(0.4) thin film, after 3 month of storage in ambient air (~ 50 % humidity), the PL spectra remains nearly the same.

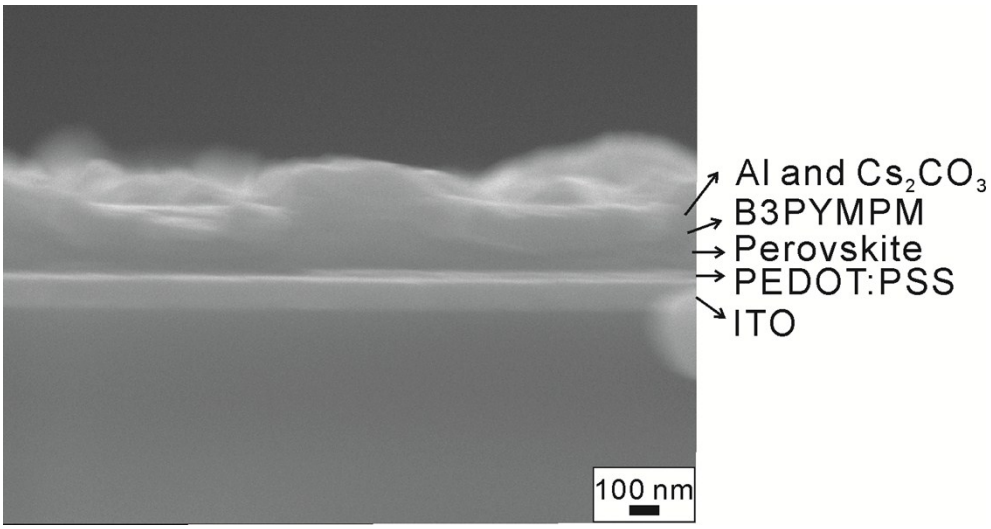

Figure S6. Cross-sectional SEM image of the LED device, showing a layer by layer structure: ITO\PEDOT:PSS\perovskite\B3PYMPM\Cs_2CO_3+Al.

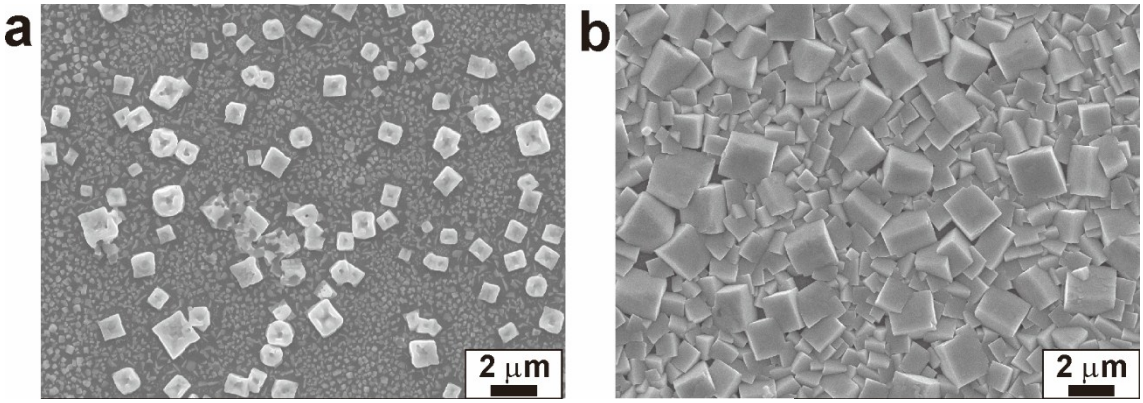

Figure S7. (a) and (b) Top-view SEM images of the as-deposited $CsPbBr_3$ and $CsPbBr_3$+CsBr(0.4) films on PEDOT:PSS.

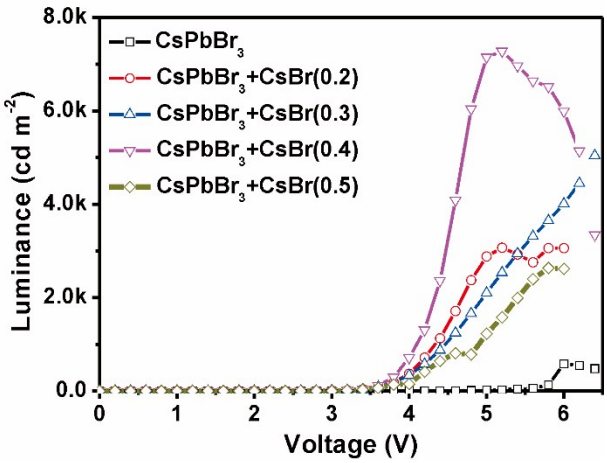

Figure S8. Luminance versus driving voltage (*L-V*) curves for perovskite films fabricated with different precursor solution.

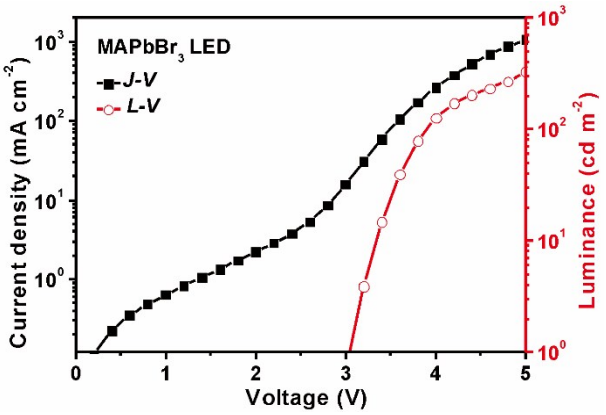

Figure S9. Luminance-current density-voltage (*L-J-V*) curve of a $MAPbBr_3$ LED device.

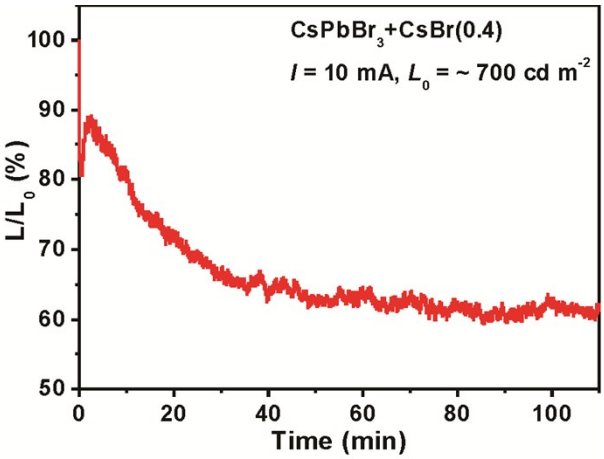

Figure S10. Ambient stability of a $CsPbBr_3$+CsBr(0.4) LED device under a constant driving current of 10 mA (J = 333.33 mA cm^{-2}), where we can see the device cannot stand at such high current density. Specifically, the device performance drops dramatically to ~ 80 % of L_0 at the very first few seconds and decreases slightly to ~ 60 % with some fluctuation in 100 min.