

Supporting information

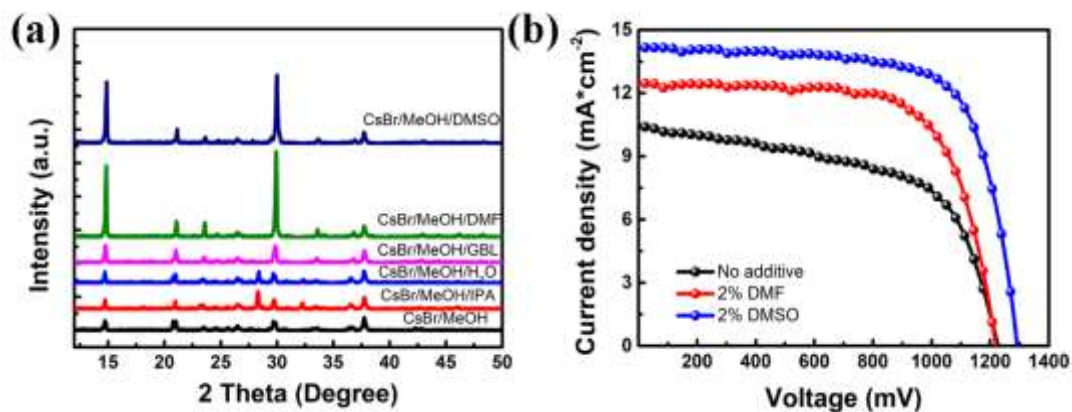


Fig. S1. (a) XRD patterns of the CsPb(I_xBr_{1-x})₃ films prepared by adding various solvent additives into CsBr/MeOH solutions. (b) Current density–voltage (J–V) curves of the CsPb(I_xBr_{1-x})₃ solar cells prepared by incorporation of DMF, DMSO and no additives to the CsBr/MeOH solutions .

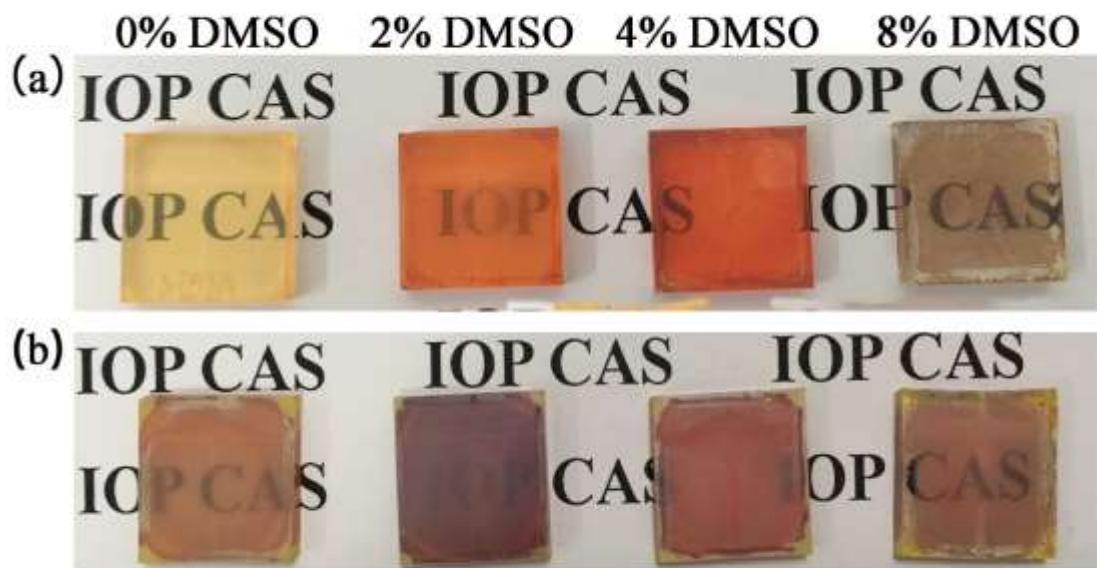


Fig. S2. Photographs of the $\text{CsPb}(\text{I}_x\text{Br}_{1-x})_3$ films prepared by different amounts of DMSO in CsBr/MeOH solutions, (a) before annealing and (b) after annealing.

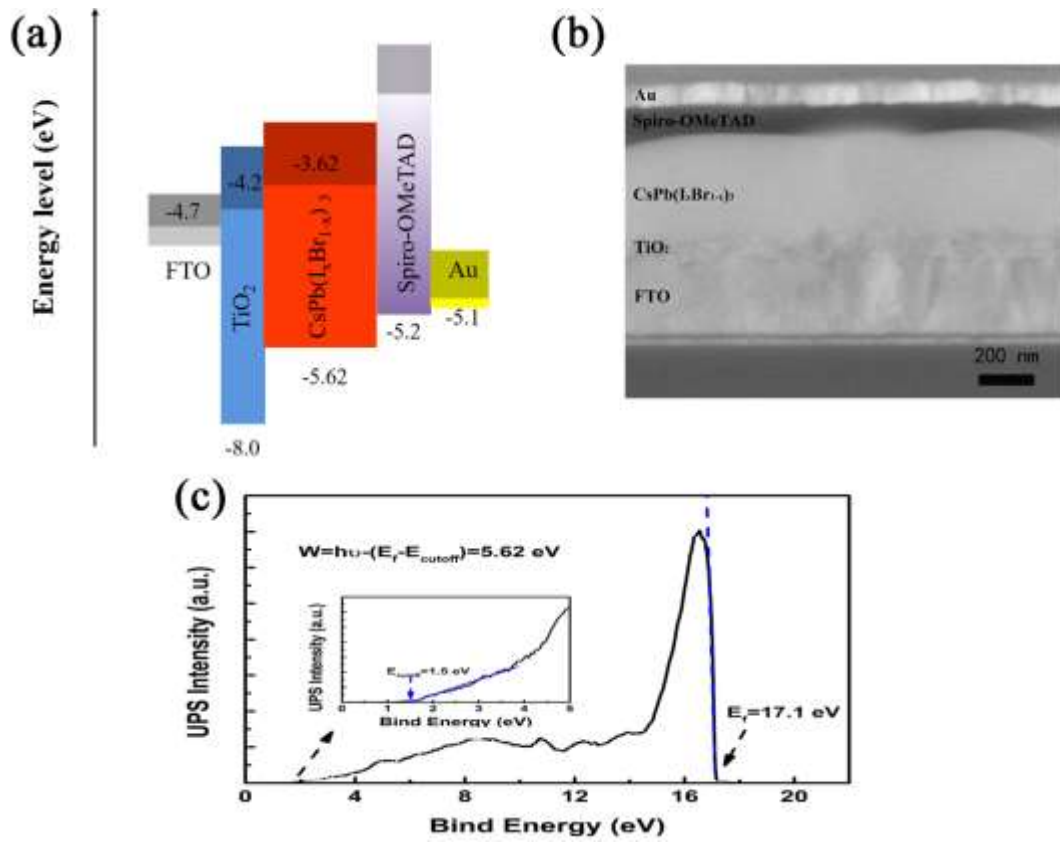


Fig. S3. (a) The energy level diagram and (b) the cross-sectional SEM image of the fabricated device with a structure FTO/bl- TiO_2 /mp- TiO_2 / $\text{CsPb}(\text{I}_x\text{Br}_{1-x})_3$ /spiro-OMeTAD/Au. The UPS spectra of the $\text{CsPb}(\text{I}_x\text{Br}_{1-x})_3$ film.

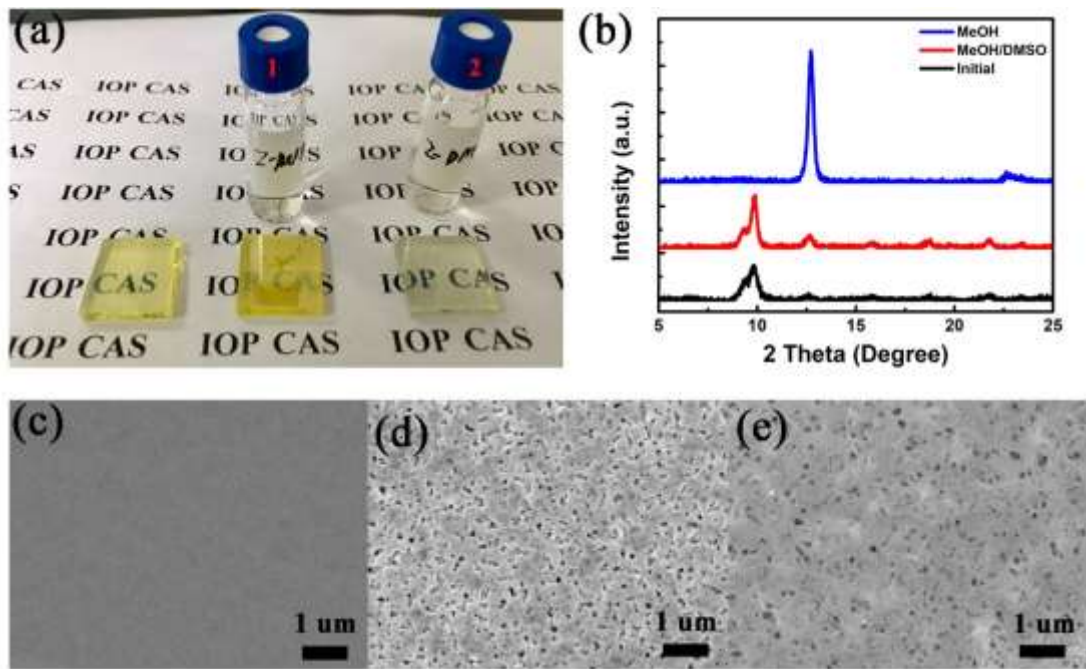


Fig. S4. (a) Photographs and (b) XRD patterns of the initial $\text{PbI}_2/\text{PbBr}_2$ films, after MeOH solutions wash and after MeOH/DMSO (2 wt%) solutions wash, (c-e) the top-down SEM images of $\text{PbI}_2/\text{PbBr}_2$ after different treatment, (c) initial, (d) after MeOH solutions wash, (e) after MeOH/DMSO (2 wt%) solutions wash.

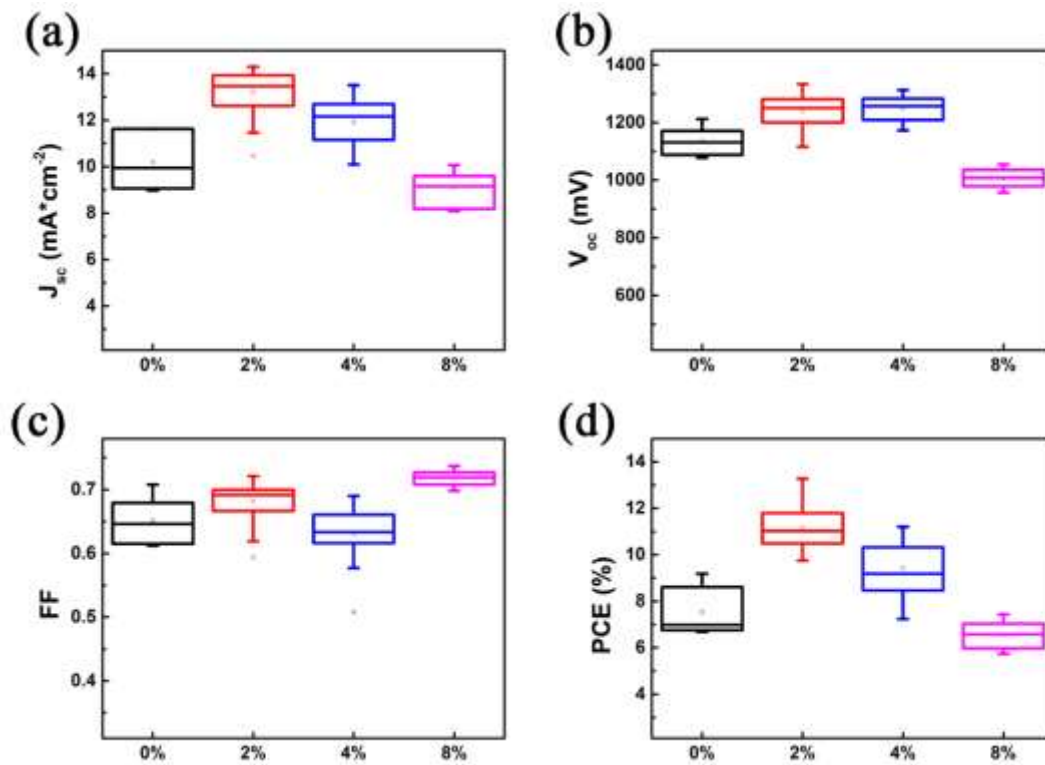


Fig. S5. Statistical results of J-V characteristics of perovskite solar cells prepared with 0, 2, 4 and 8% volume of DMSO in two-step multicycle spin-coating process. (a) J_{sc} ($\text{mA}\cdot\text{cm}^{-2}$), (b) V_{oc} (mV), (c) FF, (d) PCE(%).

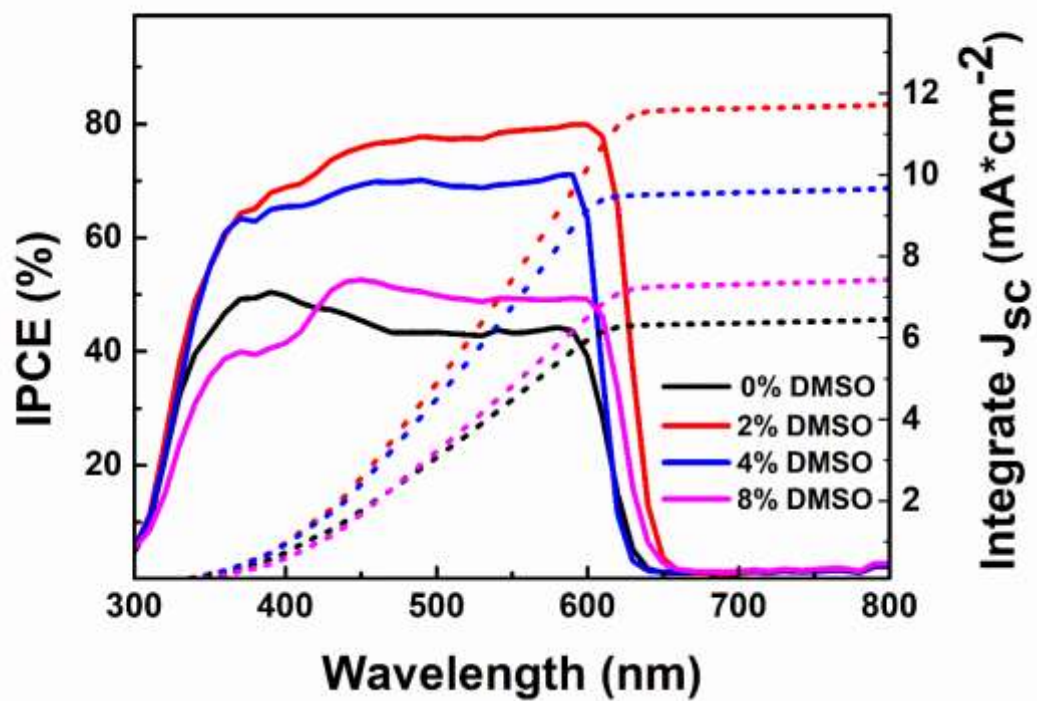


Fig. S6. IPCE and integrate J_{sc} of the $CsPb(I_xBr_{1-x})_3$ devices prepared by different amounts of DMSO in CsBr/MeOH solutions..

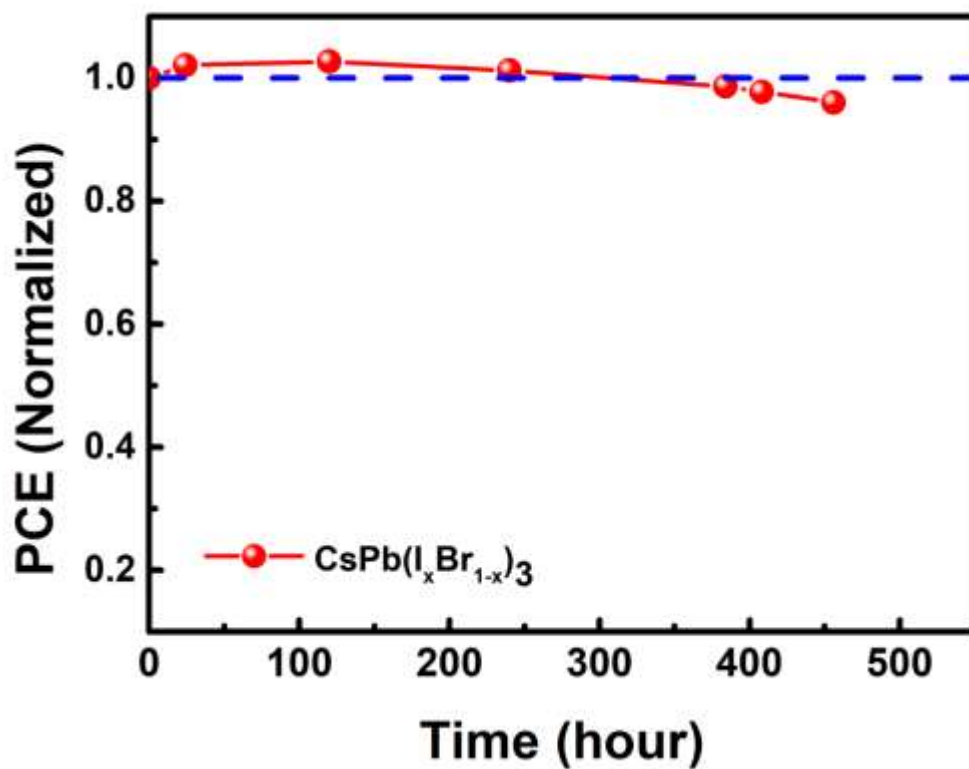


Fig. S7. The normalized PCE of the $\text{CsPb}(\text{I}_x\text{Br}_{1-x})_3$ devices as a function of the storage time. All the devices were measured in the ambient air and without encapsulation.

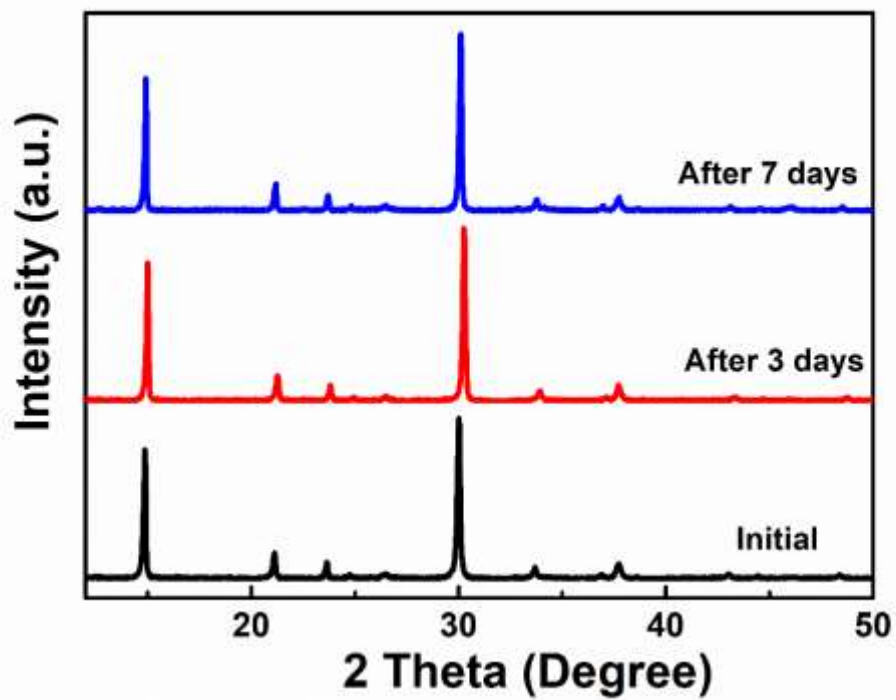


Fig. S8. XRD patterns evolution of the CsPb(I_xBr_{1-x})₃ perovskite films heated on a 80°C hotplate in air with a controlled humidity environment with <20% RH.