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Convenient Preparation of $CsSnI_3$ Quantum Dots, Excellent Stability, and the Highest Performance of Lead-Free Inorganic Perovskite Solar Cells So Far

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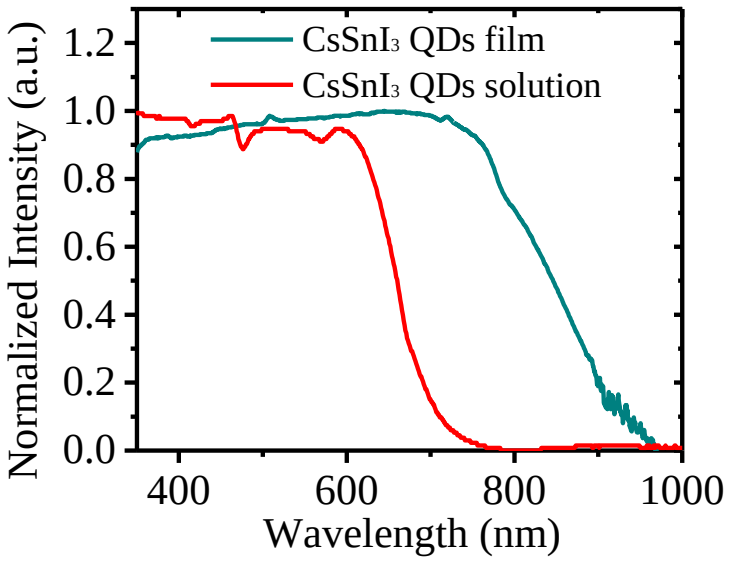


Fig. S1. UV-Vis absorption spectra of the $CsSnI_3$ QDs film and $CsSnI_3$ QDs solution with 4 *vol*% ASA after a heat treatment.

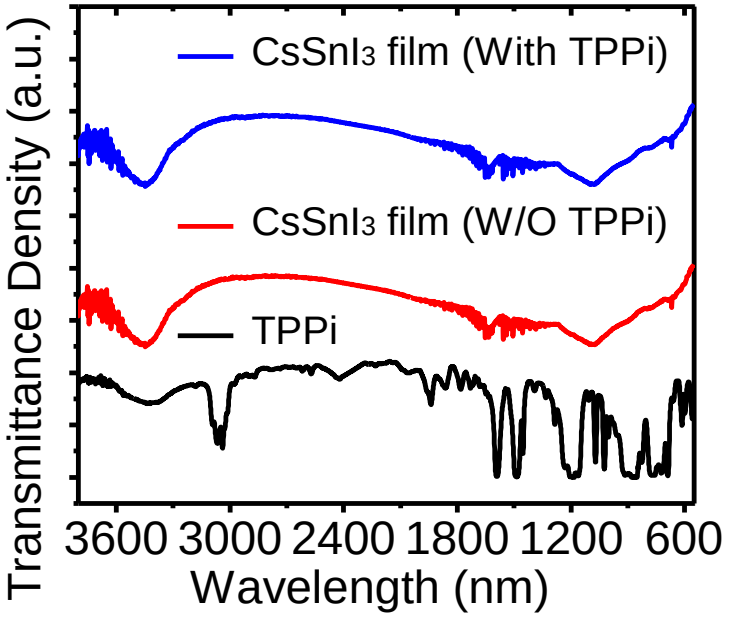


Fig. S2. IR Spectrum of the $CsSnI_3$ QDs film from the solution with and without TPPi

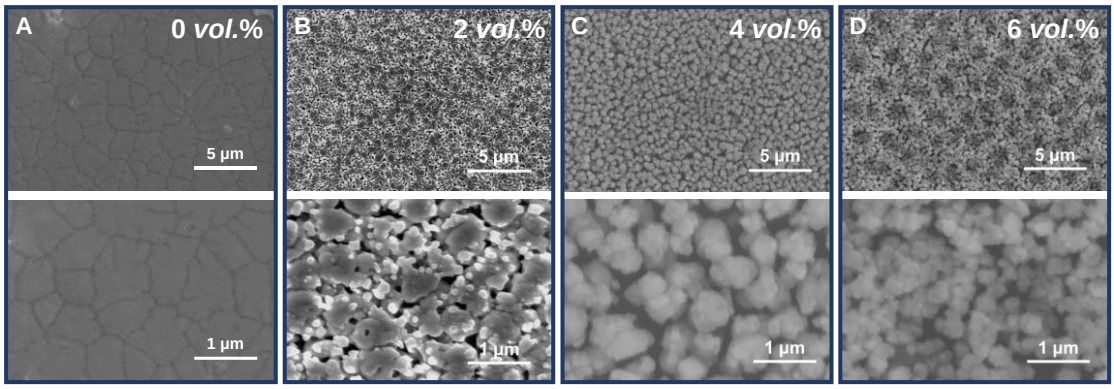
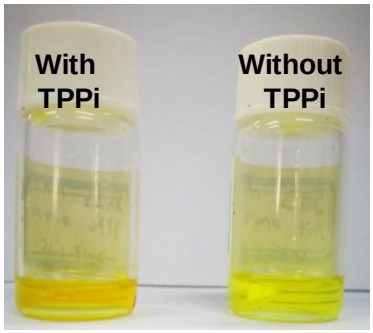


Fig. S3. The SEM images of the $CsSnI_3$ films prepared by a spin-coating method from the solution III with different ASA concentrations: (a) 0 *vol.*%, (b) 2 *vol.*%, (c) 4 *vol.*% and (d) 6 *vol.*%.



SnI_2 solution

Fig. S4. Images of the SnI_2 solution with or without TPPi dissolved in the DMF:DMSO solvent mixture solvent. The concentration of SnI_2 and TPPi were 0.5 M and 4 *vol.*%, respectively.

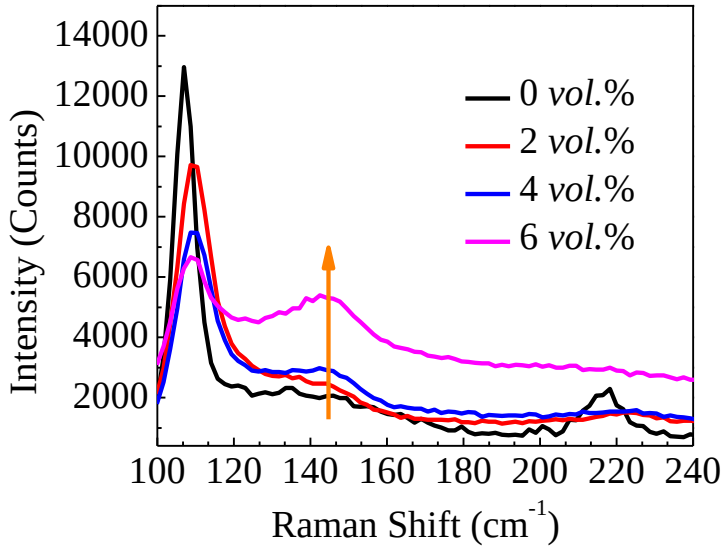


Fig. S5. Raman spectra of $CsSnI_3$ solutions containing different TPPi concentrations: 0 *vol.*%, 2 *vol.*%, 4 *vol.*% and 6 *vol.*%.

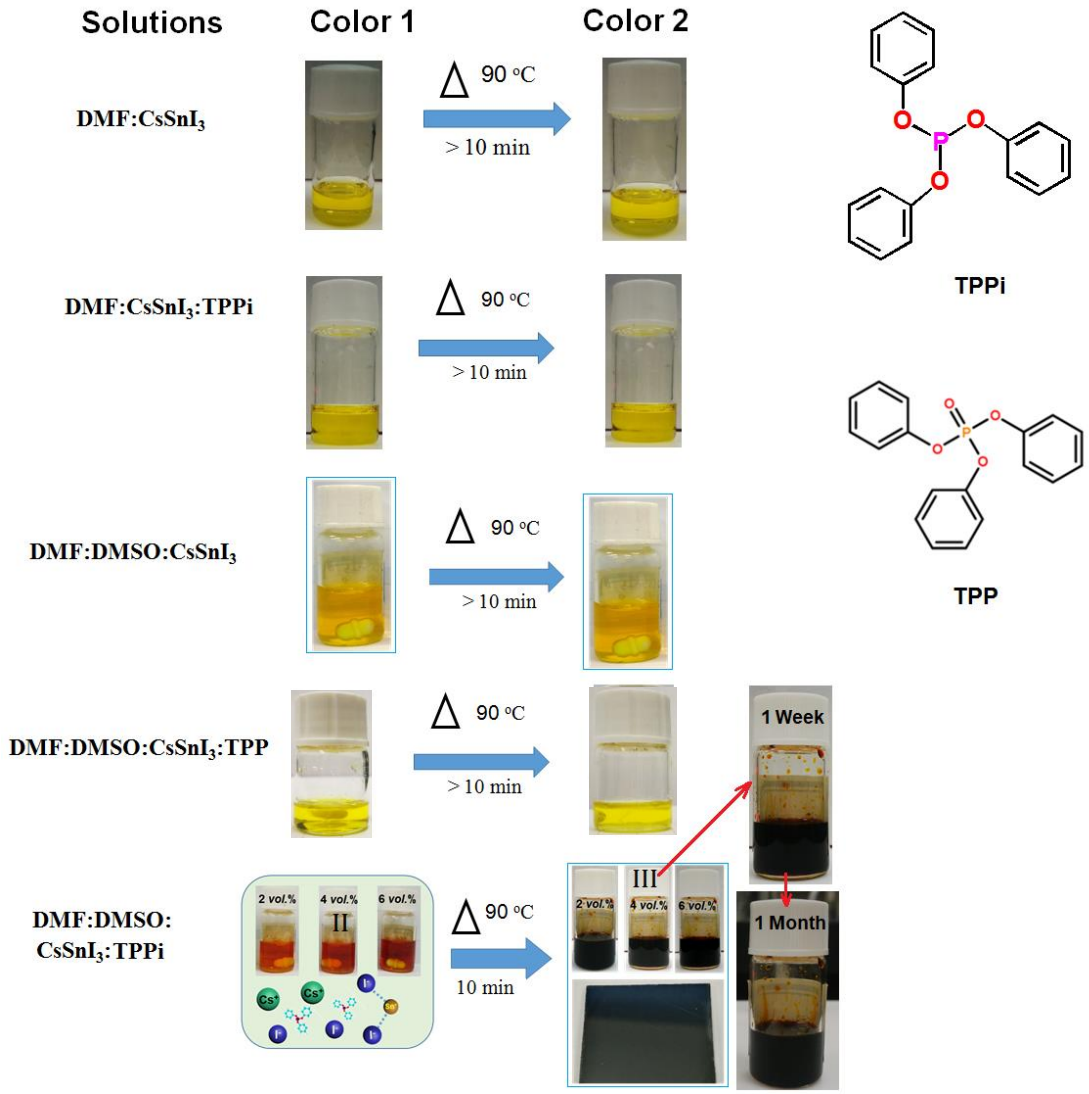


Fig. S6. Images of color comparisons of different solutions with parallel processes.

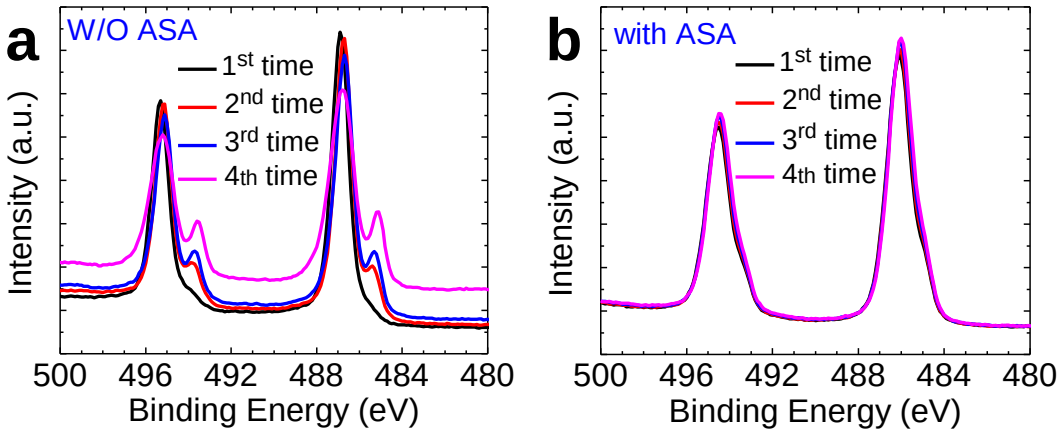


Figure S7. XPS spectra of the Sn (3d) bands on the Sn-based perovskite surface with different X-ray irradiation times (30 min each time).

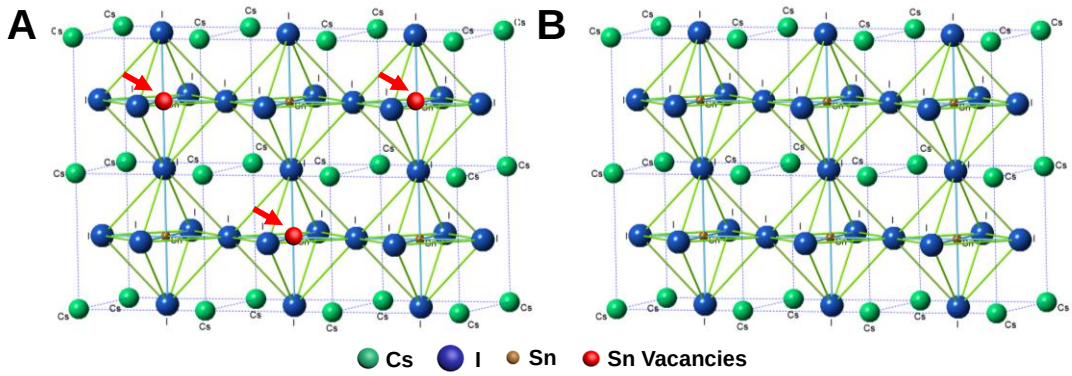


Fig. S8. The crystal structure of the $CsSnI_3$ film with an orthorhombic (Pnam) structure prepared from the solution shown in Figure 1a: (a) the film containing the doping carrier concentration from the $CsSnI_3$ solution without TPPi and (b) the film not containing the doping carrier concentration from the $CsSnI_3$ solution with TPPi.

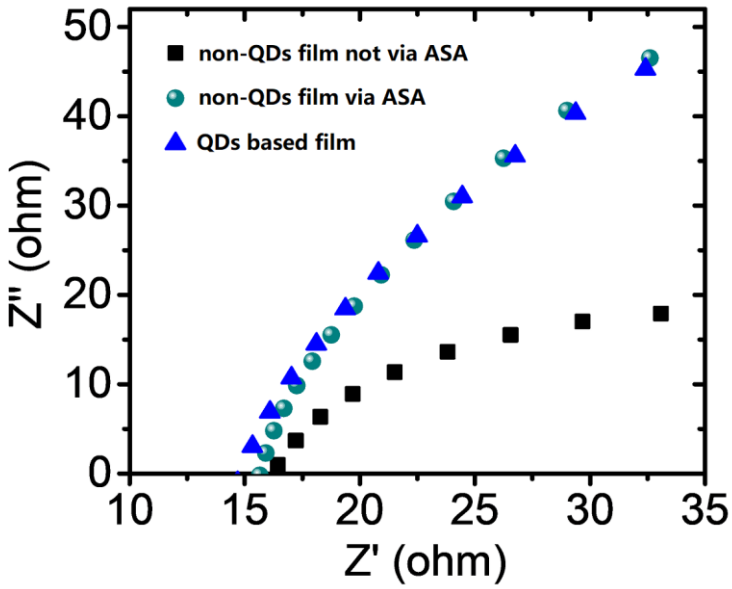


Fig. S9. The high frequency part (is associated with R_s) of EIS plots for of the ITO/PEDOT:PSS/$CsSnI_3$ (from different precursor solutions)/PCBM/Ag devices.

Tab. S1. The character fitting values of PL decay spectra shown in Figure 5c.

$CsSnI_3$ films	**τ_1 (ns)**	**τ_2 (ns)**
non-QDs film From solution I	0.20	0.22
non-QDs From solution II	0.31	0.67
QDs based film From solution III	1.38	7.01

Tab. S2. The character values of Nyquist plots of the ITO/PEDOT:PSS/$CsSnI_3$ (from different precursor solutions)/PCBM/Ag devices shown in Figure 5d.

$CsSnI_3$ films	**R_s (Ω)**	**R_{rec} (Ω)**
non-QDs film From solution I	16.33	37.58
non-QDs From solution II	15.66	147.88
QDs based film From solution III	14.79	283.12