Electronic Supplementary Material (ESI) for Materials Advances.

Solution based low temperature $CsPbI_3$ nanoparticles perovskite solar cells

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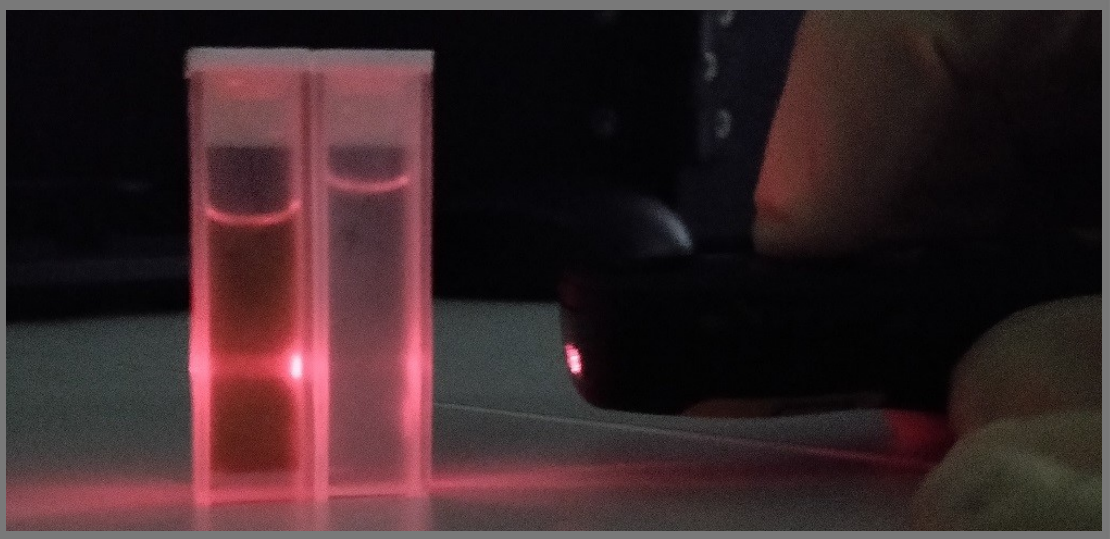

Figure S1. Demonstration of the tyndall effect by a lesser beam that was transfer through $CsPbI_3$ solutions before (right) and after (left) heating treatment.

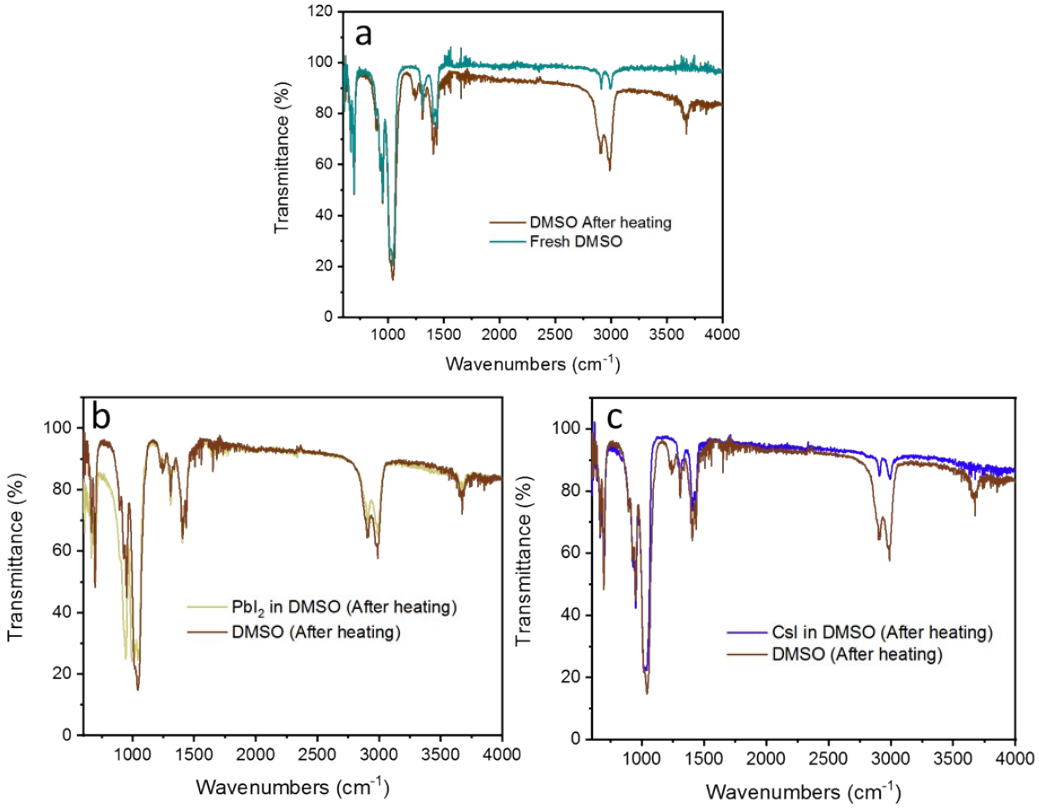

Fig S2. Fourier Transform Infrared (FTIR) Spectroscopy of (a) Fresh DMSO and DMSO after heating to 180 °C for 72 h (b) Only PbI_2 in DMSO heating to 180 °C for 72 h compare to heated DMSO (c) Only CsI in DMSO heating to 180 °C for 72 h compare to heated DMSO.

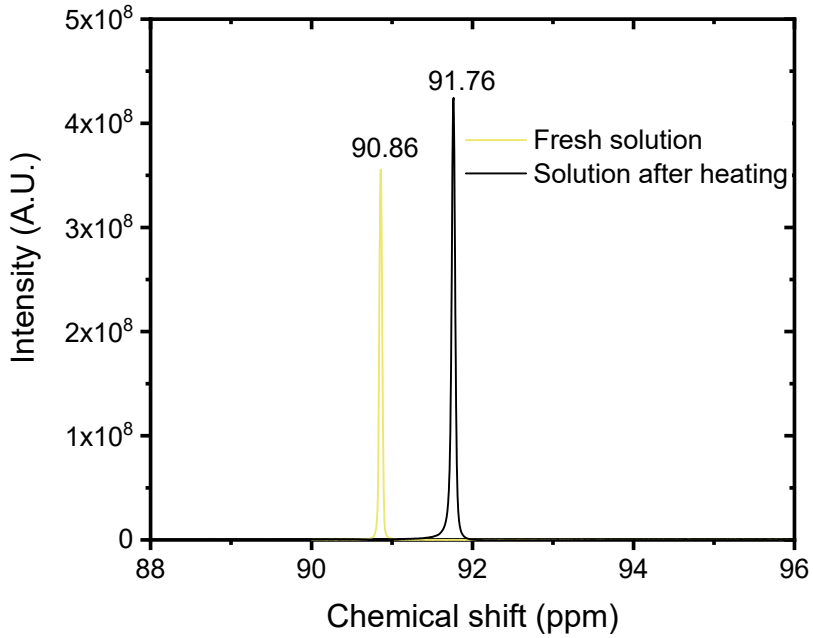

Fig S3. ^{133}Cs NMR spectrum of $CsPbI_3$ solution before and after heating.

Fig S4. Photos of the $CsPbI_3$ films after annealing at 55°C

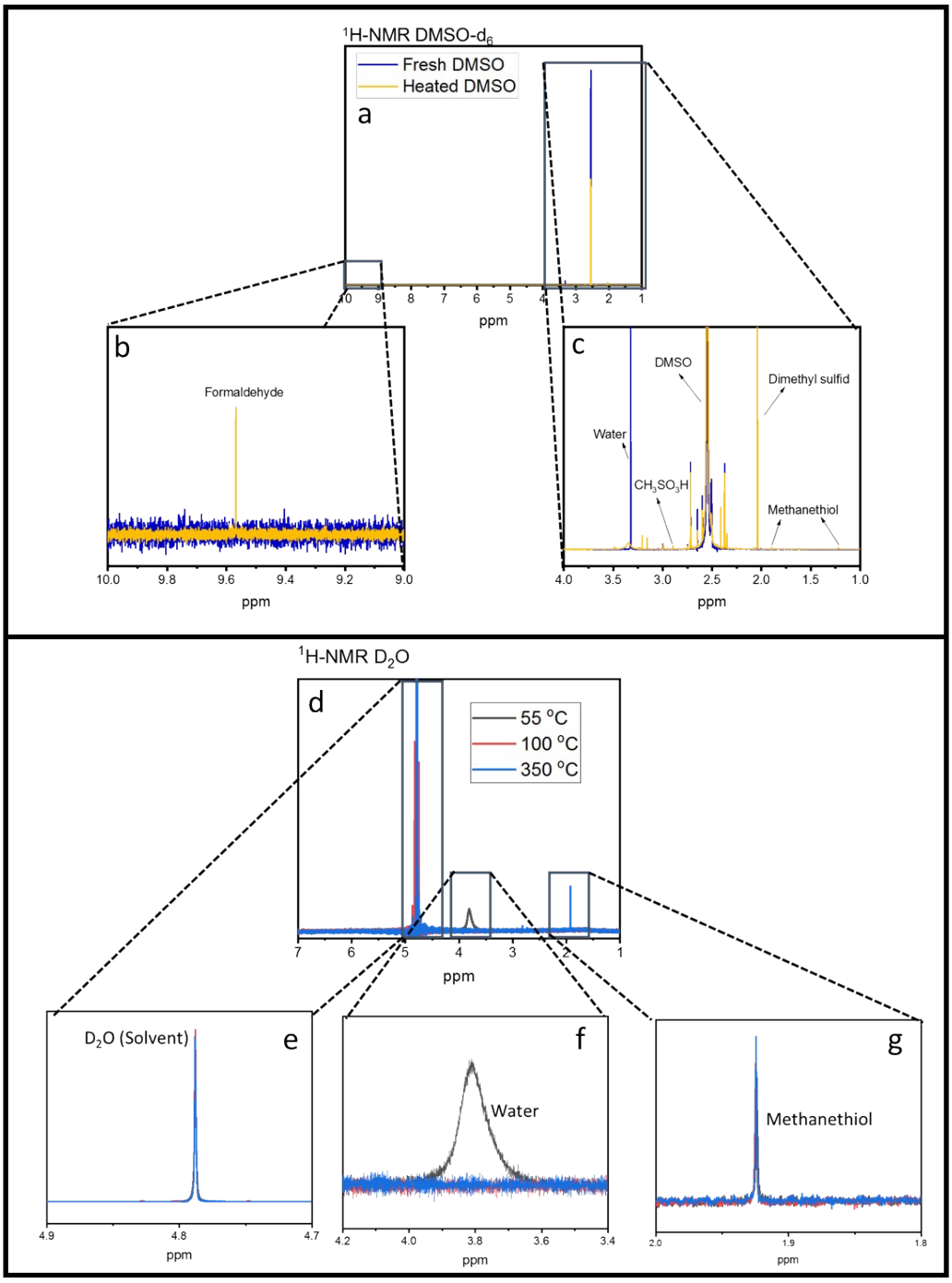

Fig S5. (a) ^{1}H-NMR (DMSO-d$_6$ as solvent) of fresh DMSO (blue) and DMSO after heating (yellow) (b) magnification of 1-4 ppm (c) magnification of 9-10 ppm. (d) ^{1}H-NMR (D$_2$O as solvent) of films under annealing process at different temperatures 55 °C (gray), 100 °C (red) and 350 °C (blue) (e) magnification of 4.7-4.9 ppm (f) magnification of 3.4-4.2 ppm and (g) magnification of 1.8-2.0 ppm

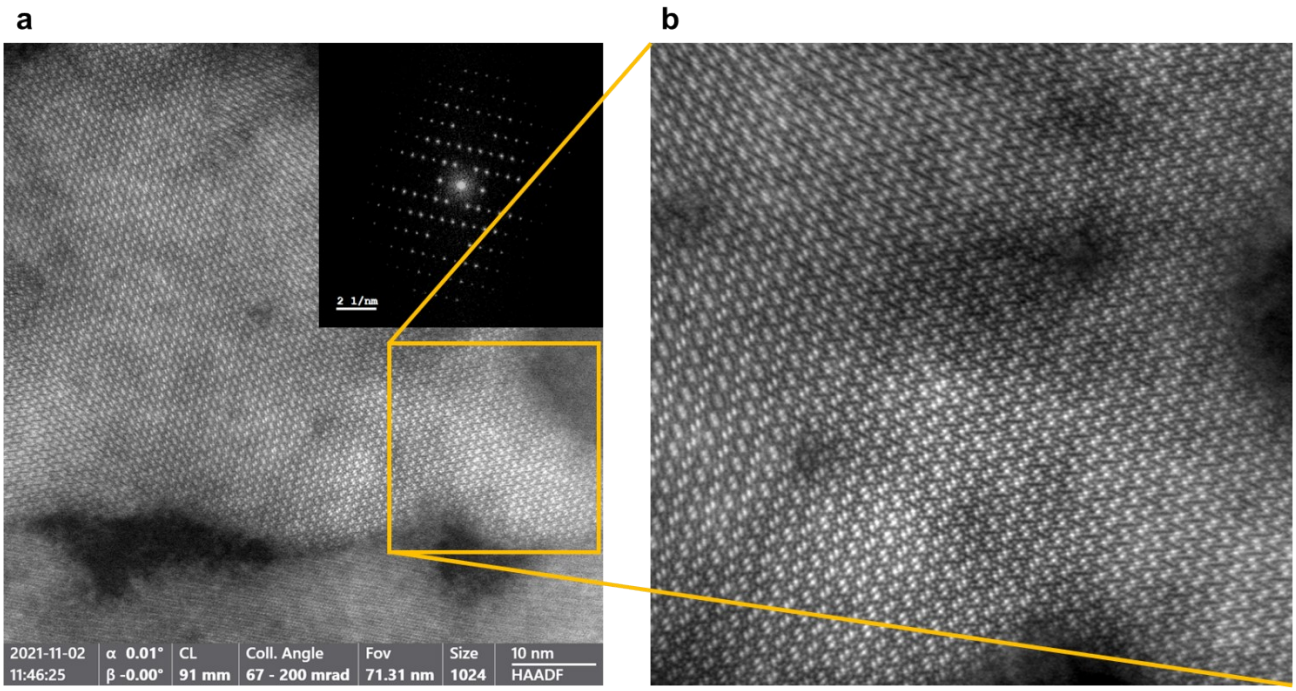

Figure S6. (a) HAADF STEM of $CsPbI_3$ NPs. Inset: FFT image of the corresponding sample. (b) magnification of a specific area in the sample.

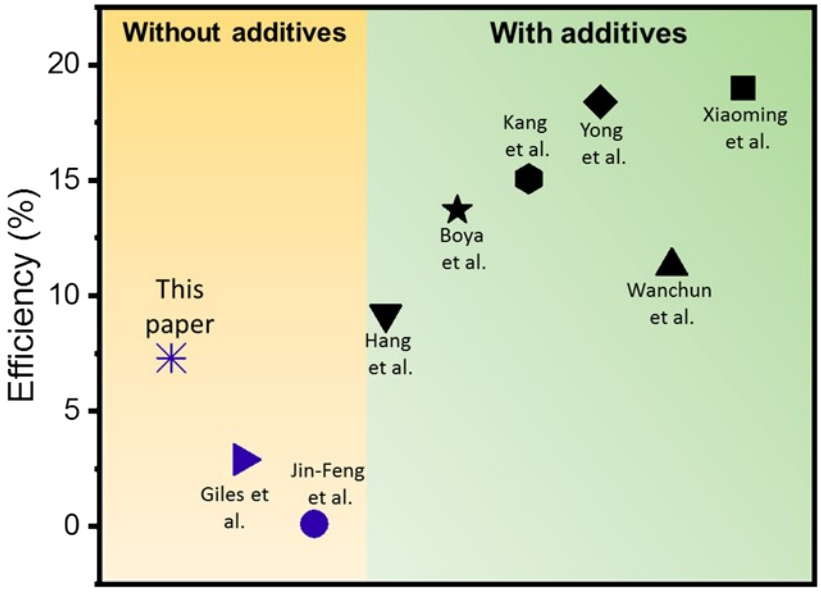

Figure S7. Graph of the efficiency without (yellow) and with additives (green) for $CsPbI_3$ based SCs

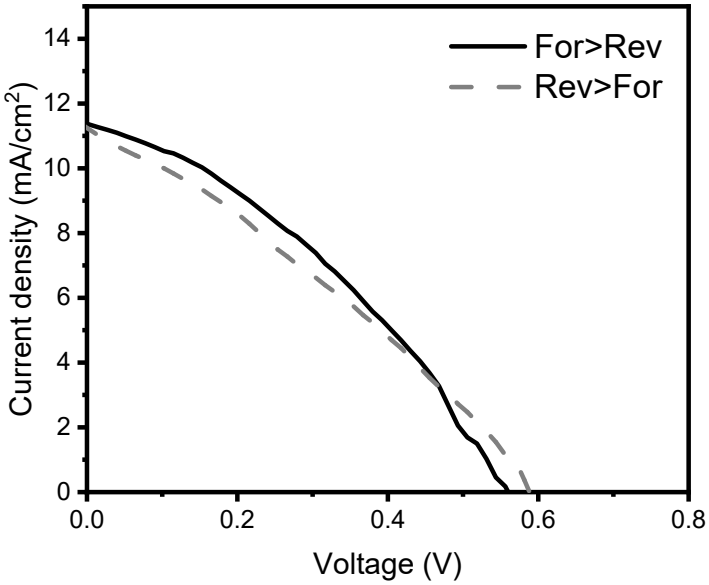

Fig S8. Current-voltage curves for forward and reverse scans