

Electronic Supplementary Information

Investigation on the role of Lewis bases in ripening process of perovskite films for highly efficient perovskite solar cells

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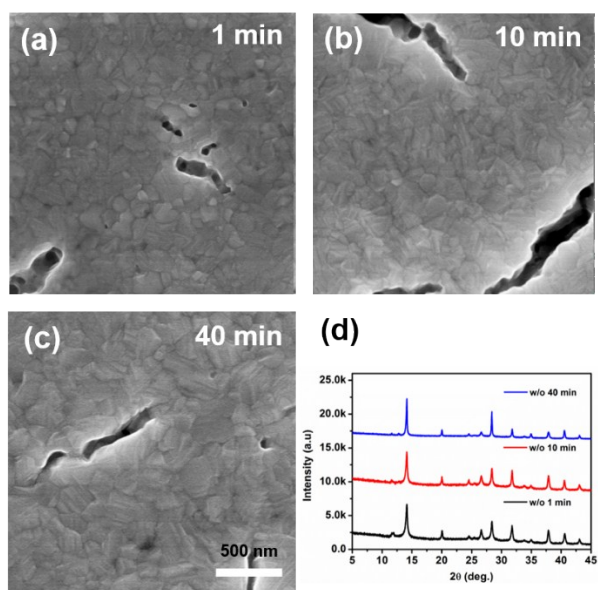


Fig. S1 SEM images of perovskite films derived from the precursor without Lewis base annealed for (a) 1 min, (b) 10 min and (c) 40 min. (d) XRD patterns of as-prepared perovskite films.

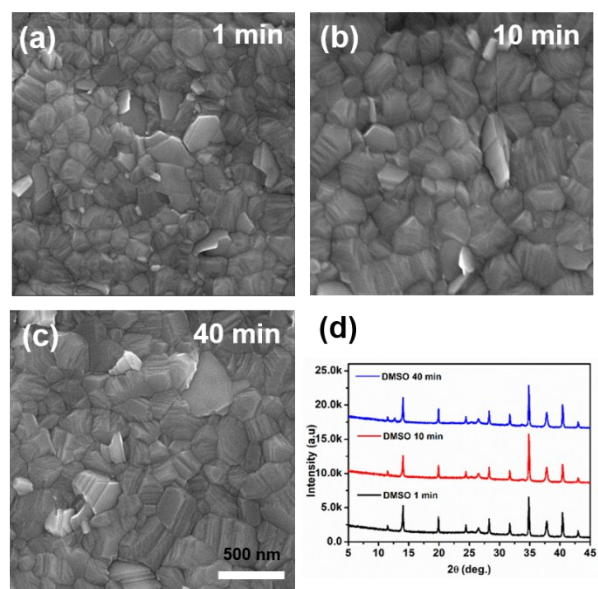


Fig. S2 SEM images of perovskite films obtained from the DMSO-based precursor annealed for (a) 1 min, (b) 10 min and (c) 40 min and their corresponding XRD patterns (d).

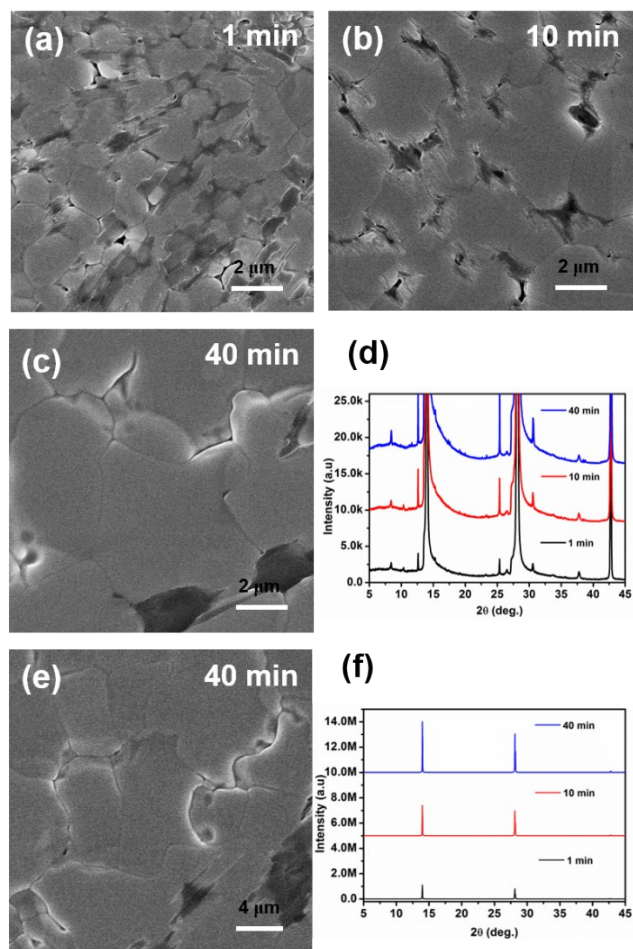


Fig. S3 SEM images of perovskite films obtained from thiourea-based precursor annealed for (a) 1 min, (b) 10 min, (c) and (e) 40 min (in different scale bar); (d) and (f) corresponding XRD patterns.

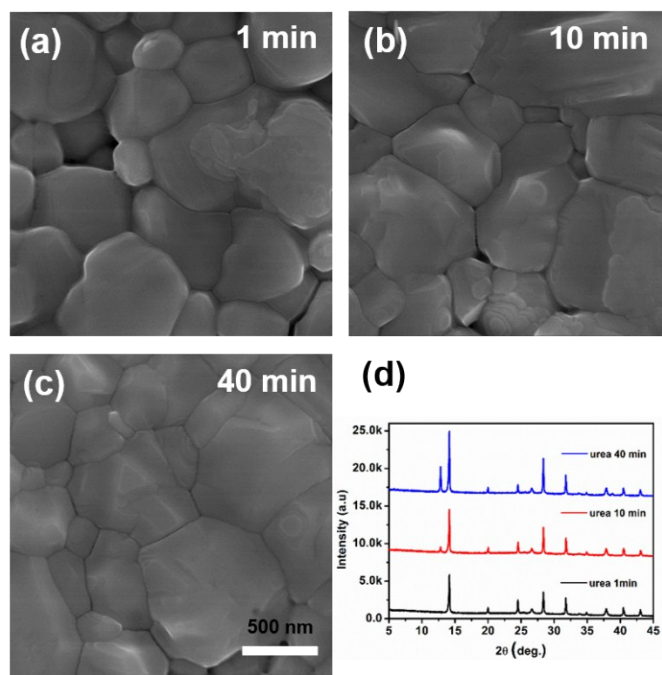


Fig. S4 SEM images of perovskite film obtained from precursor with urea annealed for (a) 1 min, (b) 10 min and (c) 40 min. (d) XRD spectra of perovskite film of (a), (b) and (c).

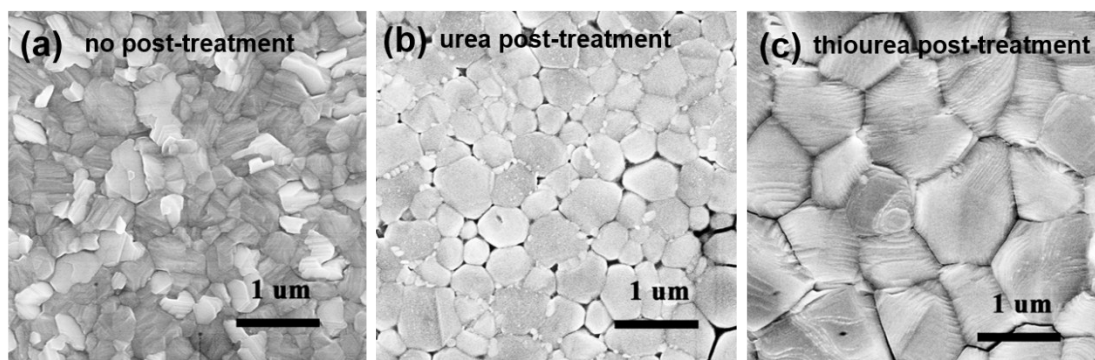


Fig. S5 SEM images of perovskite films from the DMSO-based precursor, (a) annealed for 40 min without any treatment; (b)-(c) with post-treatment (first annealed for 10 min, then spin-coated with a urea or thiourea isopropanolic solution and finally annealed for another 30 min).

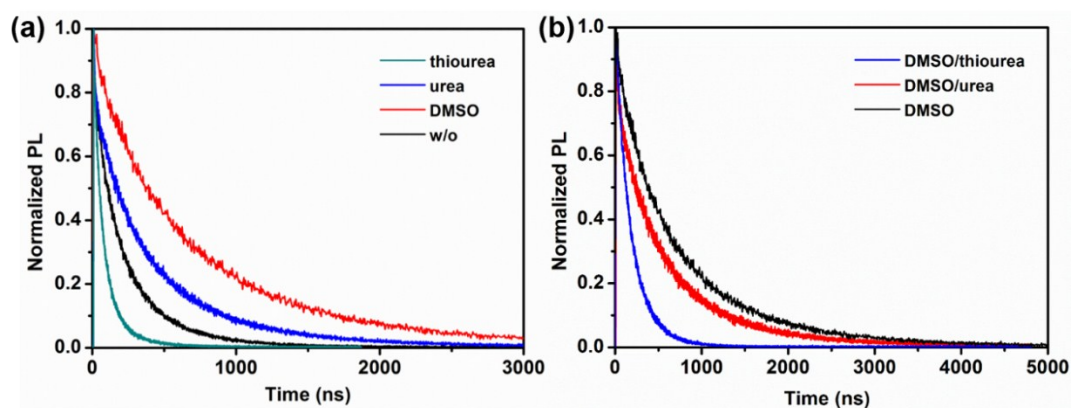


Fig. S6 Time-resolved transient PL decay curves of perovskite films deposited on TiO_2 substrates which are derived from different precursors (a) individually with DMSO, urea and thiourea or without Lewis base; (b) with mixed Lewis bases.

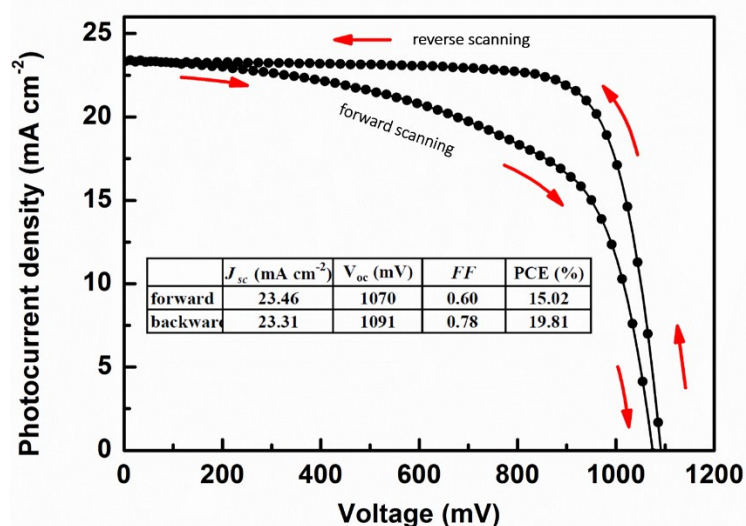


Fig. S7 I-V curves of the perovskite solar cell derived from the DMSO/urea-based precursor in different scan directions with $30 \text{ mV} \cdot \text{s}^{-1}$ scanning speed.