## **Electronic Supplementary Information (ESI)**

## Highly efficient and stable planar heterojunction perovskite solar cells *via* low temperature solution process

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Fig. S1 XRD patterns of the volatile deposited on an ITO/Glass substrate during annealing in a partly covered petri dish (i.e., the slow growth process). For comparison, the XRD spectra measured for the ITO/Glass substrate and the CH<sub>3</sub>NH<sub>3</sub>Cl powder were also included in Fig. S1. The diffraction peaks from the CH<sub>3</sub>NH<sub>3</sub>Cl are marked by open triangles ( $\Box$ ), while the peaks from the substrate are indicated by solid triangles ( $\Box$ ). The results confirm the perovskite phase (CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub>) formation along with the sublimation of CH<sub>3</sub>NH<sub>3</sub>Cl.



Fig. S2 J-V characteristics measured under AM 1.5 G illumination (100 mW cm<sup>-2</sup>) for the perovskite solar cells with different thicknesses of ZnO interlayer. The thicknesses of ZnO interlayer were adjusted by varying the speed of spin-coating, which has been indicated by the legend of Fig. S2. According to Fig. S2, the optimized speed for the spin-coating of ZnO was determined to be 3000 rpm, corresponding to a ZnO thickness of 110 nm.



Fig. S3 Dependence of (a)  $J_{SC}$ , (b)  $V_{OC}$ , (c) FF, and (d) PCE on the light intensity for a typical slow-grown perovskite solar cell. The  $\delta V_{OC} \sim \text{In}(I)$  was fitted by a linear relationship with a slope of 0.049 (1.89 $K_{\rm b}T/q$ ), as indicated by a red solid line In Fig. S3b.



Fig. S4 XRD patterns of the slow-grown perovskite solar cell measured after storing in ambient air for different times. All the diffraction peaks originate from the perovskite phase ( $CH_3NH_3PbI_{3-x}Cl_x$ ), and the peak intensity remains almost unchanged with the storage time, indicating excellent device stability.