The growth of $CH_3NH_3PbI_3$ thin film by simplified close space sublimation for efficient and large dimensional perovskite solar cells

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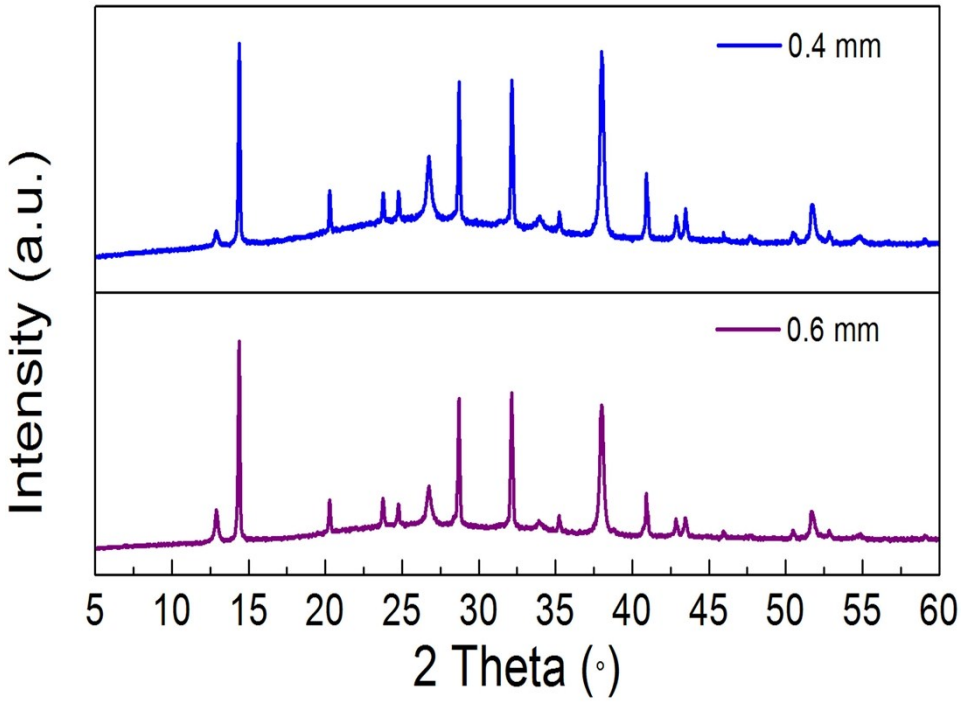

Figure S1. X-ray diffraction (XRD) pattern of perovskite films deposited on the FTO/PEDOT:PSS substrate (annealed for 2.5 h) with the sublimation distance of 0.4 and 0.6 mm, respectively.

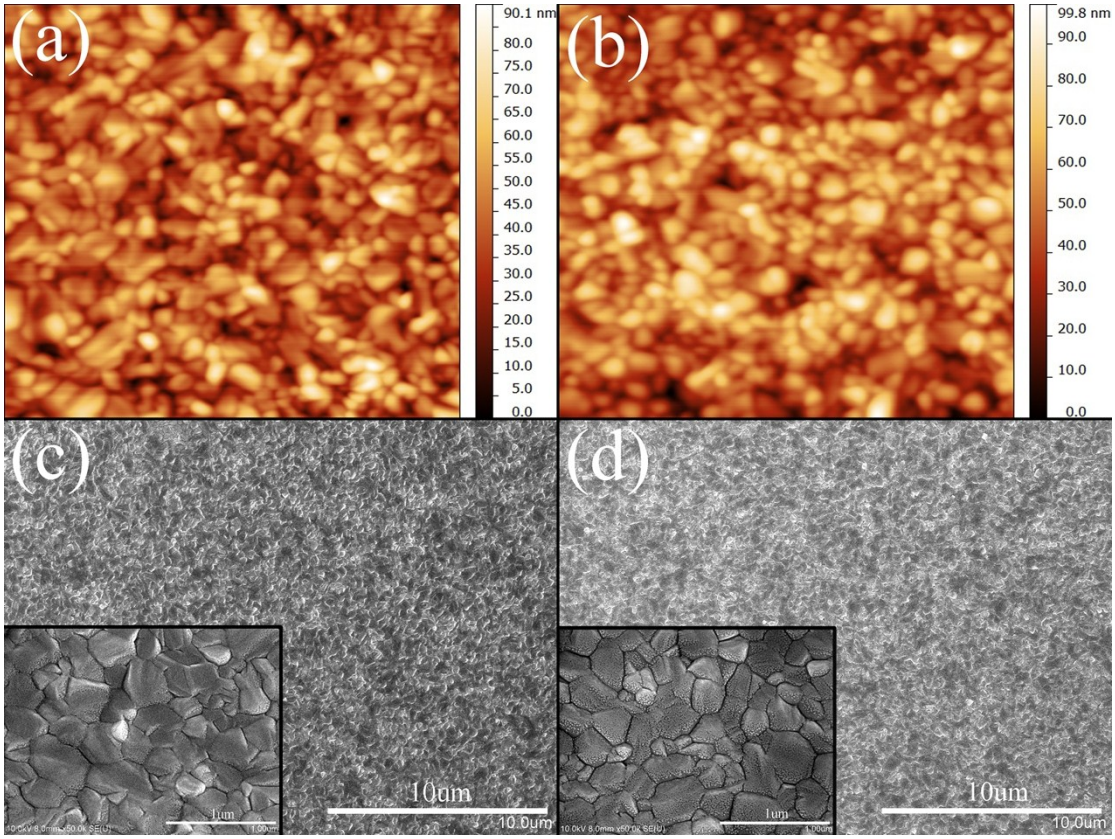

Figure S2. AFM (5μm×5μm) and top-view **SEM** (inset image with scale bar of 1μm) images of perovskite films annealed for 2.5 h with the sublimation distance of 0.4 **(a, c)** and 0.6 mm **(b, d)**, respectively.

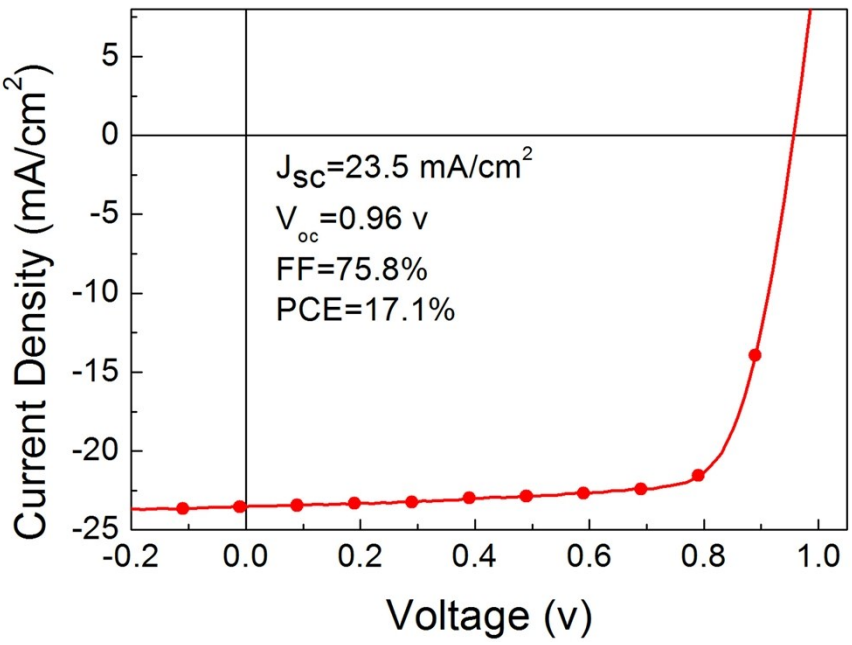

Figure S3. Current-voltage (*J-V*) characteristic curve of the champion cell (4 mm^2).

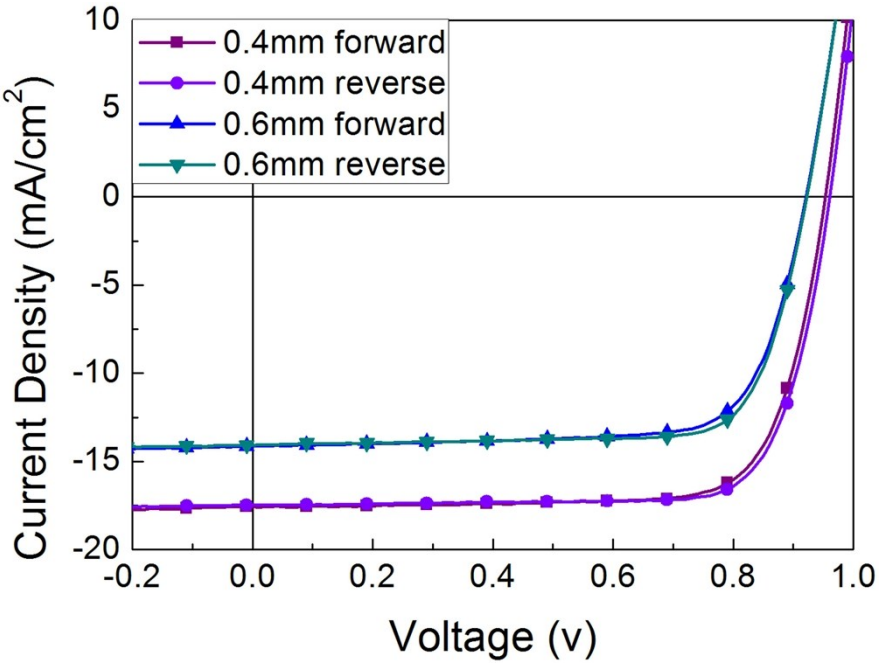

Figure S4. Current-voltage (*J-V*) characteristic curves of perovskite devices with the sublimation space of 0.4 and 0.6 mm.

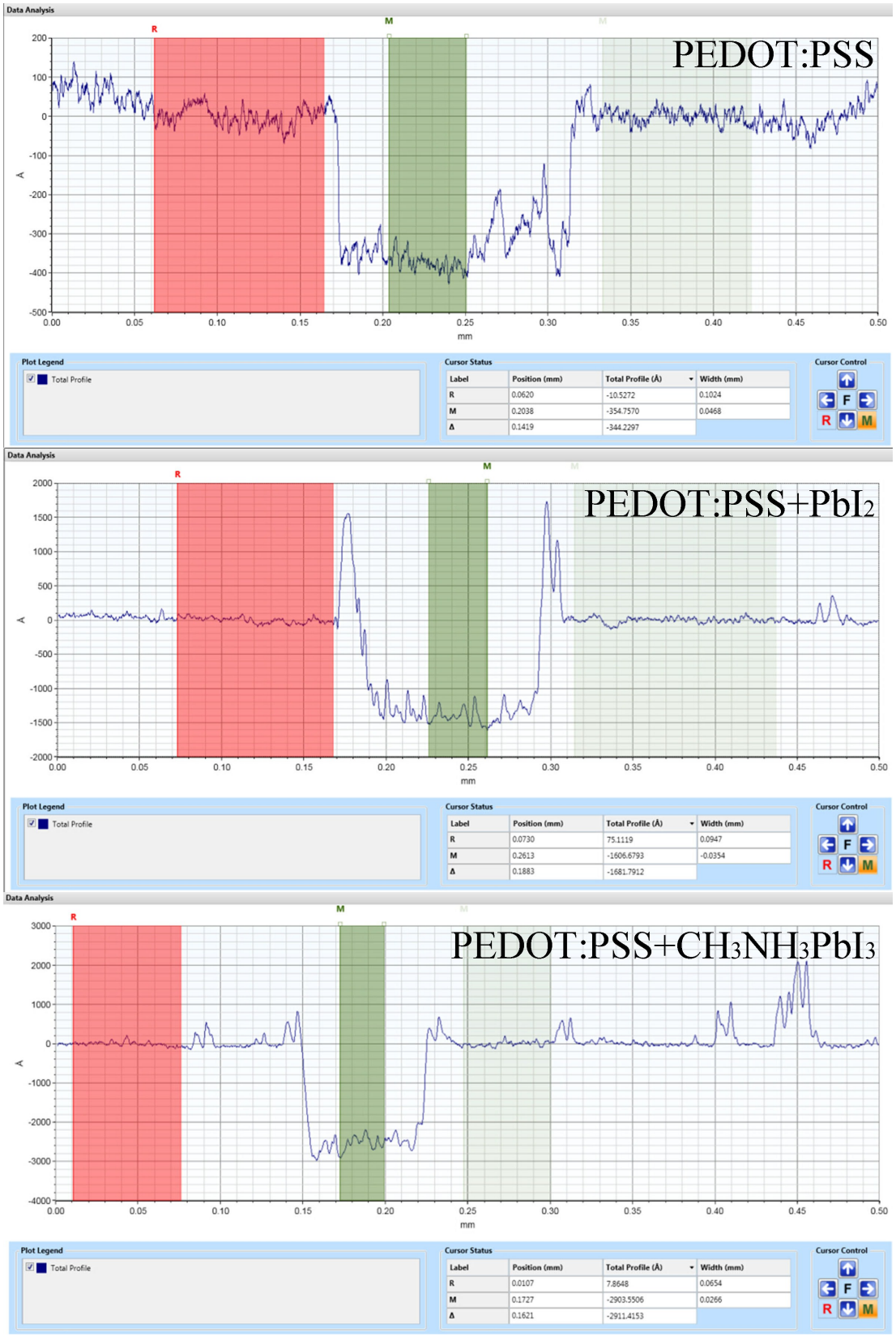

Figure S5. Thickness of PEDOT:PSS layer, PbI_2 film and $CH_3NH_3PbI_3$ film deposited on PEDOT:PSS substrate measured by Dektak XT profilometer.

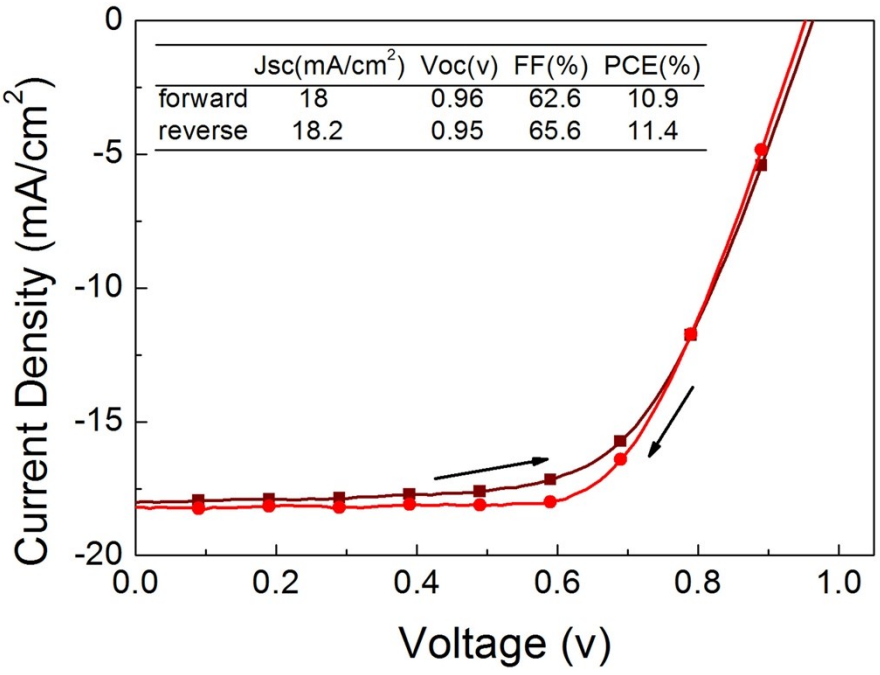

Figure S6. Current-voltage (*J-V*) characteristic curves of perovskite device (100 mm^2) fabricated with FTO glass with sheet resistance of 7 Ω/sq.

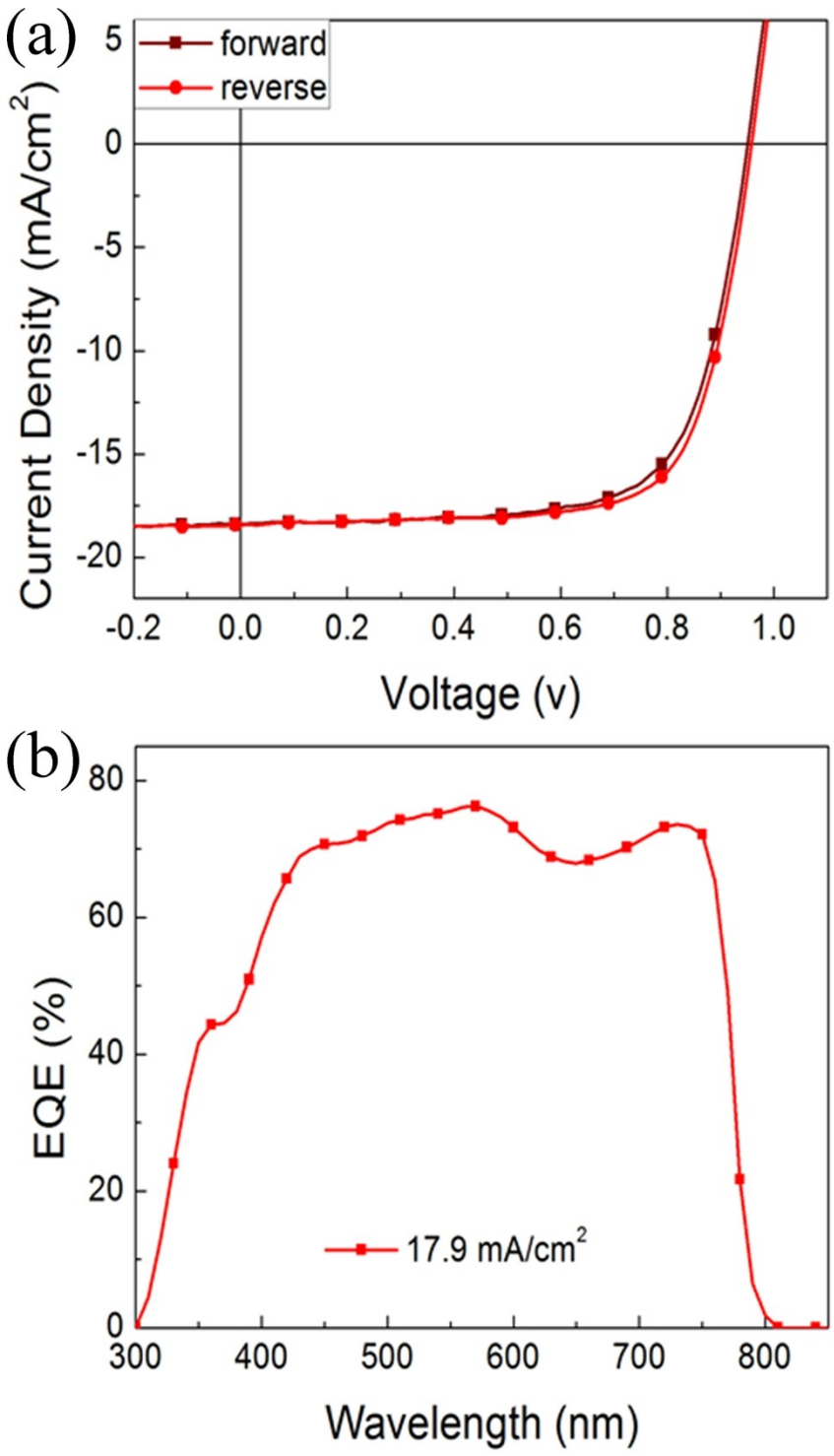

Figure S7. (a) Current-voltage *(J-V)* characteristic curves and **(b)** External quantum efficiency (EQE) curve of perovskite devices with the $CH_3NH_3PbI_3$ film grown in standard atmosphere.