Supporting Information for

Approaching 100% coverage $CH_3NH_3PbI_{3-x}Cl_x$ films with highly oriented crystal domains for reproducible and efficient planar heterojunction perovskite solar cells

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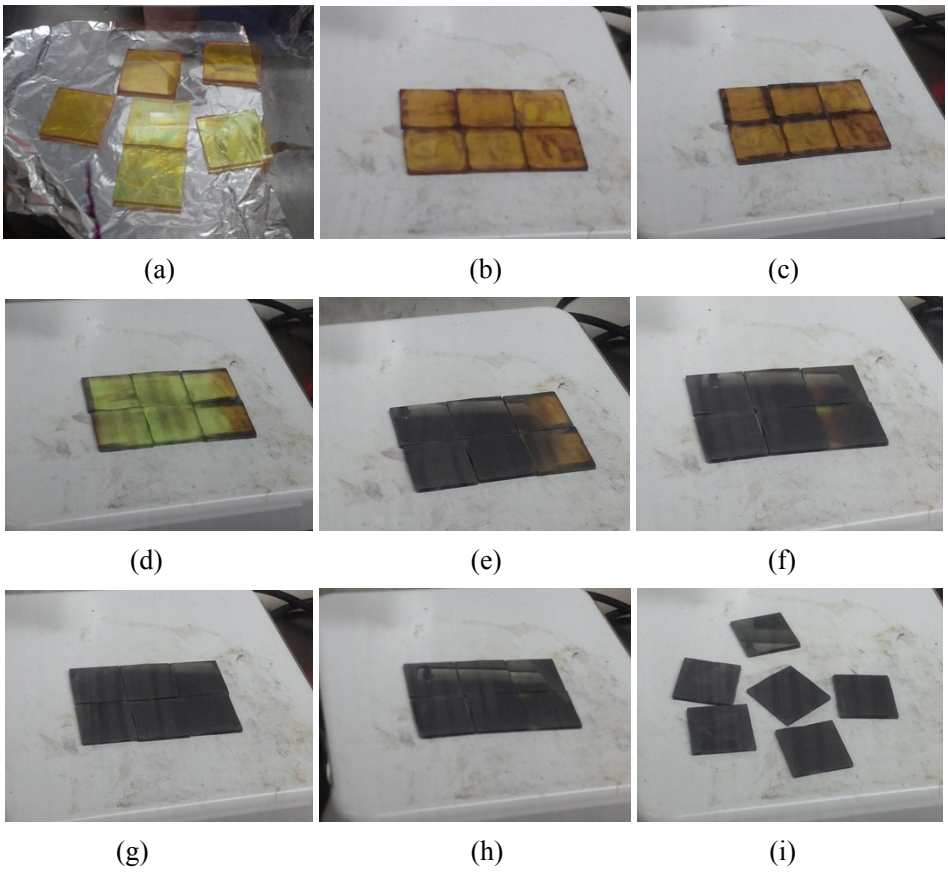

Figure S1. Optical images of the perovskite film heated at different stage, 0 min (a), 5 min (b), 15 min (c), 55 min (d), 65min (e), 75 min (f),85 min (g), 95 min (h), 105 min (i), respectively.

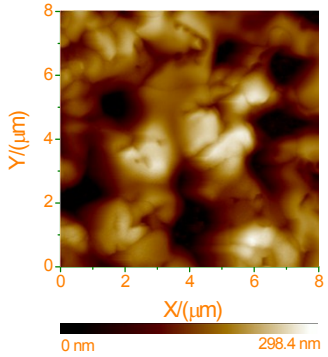

Figure S2. AFM image of the same perovskite /c-TiO2 sample characterized in **Figure 3**.

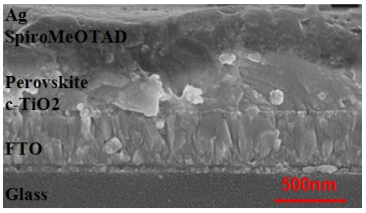

Figure S3. Cross-sectional SEM image of the device with a structure of Glass/FTO/c-TiO_2/Perovskite/SpiroMeOTAD/Ag

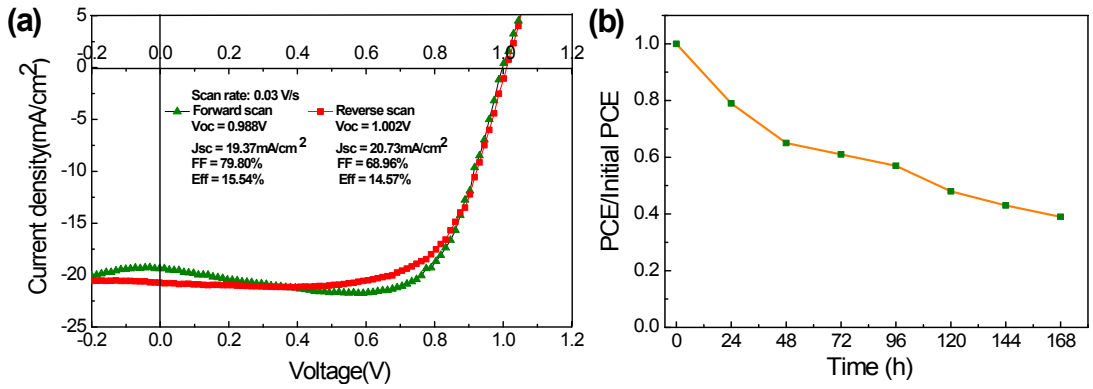

Figure S4. The *J-V* hysteresis analyze (a) and stability as a function of time (b) of the perovskite solar cell.

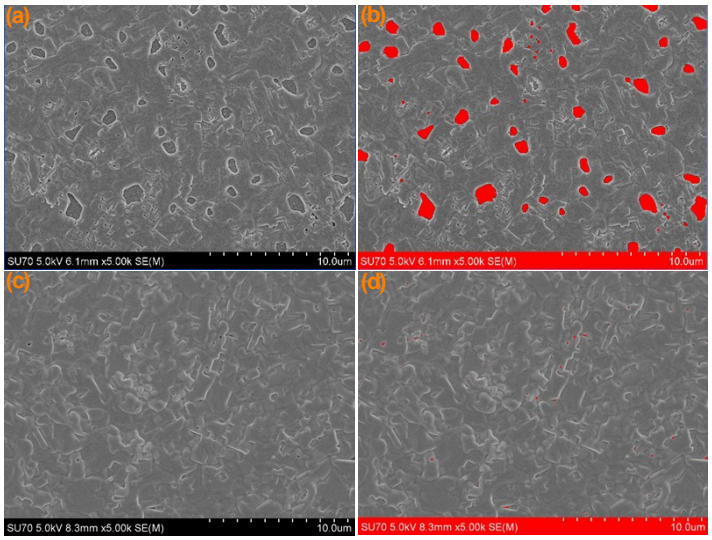

Figure S5. Original SEM images (a, corresponding to Fig.2 (b) in the main text) and void-labeled SEM images (b) of the perovskite film with a coverage of 95.72%. Estimated coverage is 95.63 (±0.25%) based on the integration of the red area in (b). Original SEM images (c, corresponding to Fig.2 (d) in the main text) and void-labeled SEM images (b) of the perovskite film with a coverage approaching 100%. Estimated coverage is 99.85% (±0.10%) based on the integration of the red area in (d).