Supplementary Information for “Domain Size Control of Perovskite Thin Films via Colloidal Monolayer Lithography”

Maximilian T. Hörantner,† Wei Zhang,† Michael Saliba, Konrad Wojciechowski, Henry J. Snaith*

Supporting Figures

**Figure S1.** AFM measured 3D profile of 15 Ohm/square FTO glass before (left) and after (right) deposition of c-TiO$_2$. The root mean square roughness was calculated to be 10.5 and 5.2 nm.

**Figure S2.** AFM measured 3D profile of TiO$_2$ honeycomb structure (left). Line profile of TiO$_2$ honeycomb structure with indicated level of 300 nm thick perovskite filling.
Figure S3. XRD patterns of perovskite films within SiO₂ honeycombs (top) or on top of FTO/c-TiO₂ substrates (bottom) deposited from 20 wt% precursor solution. The patterns are showing good similarity with the typical tetragonal CH₃NH₃PbI₃ patterns and lattice parameters (a=8.884, c=12.61 and a=8.874, c=12.62) were determined via a Rietveld refinement with χ²=4.7 and χ²=9.8). By Scherrer equation, crystallite sizes were estimated to be equal to around 110-120 nm (top) and 150-190 nm (bottom), respectively. Therefore we see a slight increase in crystallite size for the unconfined perovskite films deposited on FTO/c-TiO₂ substrates but the difference is not significant.
Figure S4. J-V characteristic curve for a SiO$_2$ honeycomb structured perovskite solar cell fabricated with 30 wt% precursor solution, scanning from forward bias to short circuit direction with a scan rate of 0.15 V/s.

Figure S5. J-V characteristic curves for forward and backward scan of SiO$_2$ honeycomb structured perovskite solar cell fabricated with 10 and 20 wt% perovskite precursor solution (scan rate 0.15 V/s).
Figure S6. Stabilized current density and PCE of a SiO$_2$ honeycomb device fabricated from 20 wt% perovskite precursor solution, held at the maximum power voltage of 0.74 V for 120 seconds. This device shows a $J_{SC}$ of 10.5 mA/cm$^2$, a PCE of 7.5%, a FF of 0.77 and a $V_{OC}$ of 0.9 V in the J-V measurement scanning from forward bias to short circuit direction under simulated AM1.5 100 mWcm$^{-2}$ simulated sun light.