Supporting Information

Inkjet-printed Triple Cation Perovskite Solar Cells

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Surface Topography:

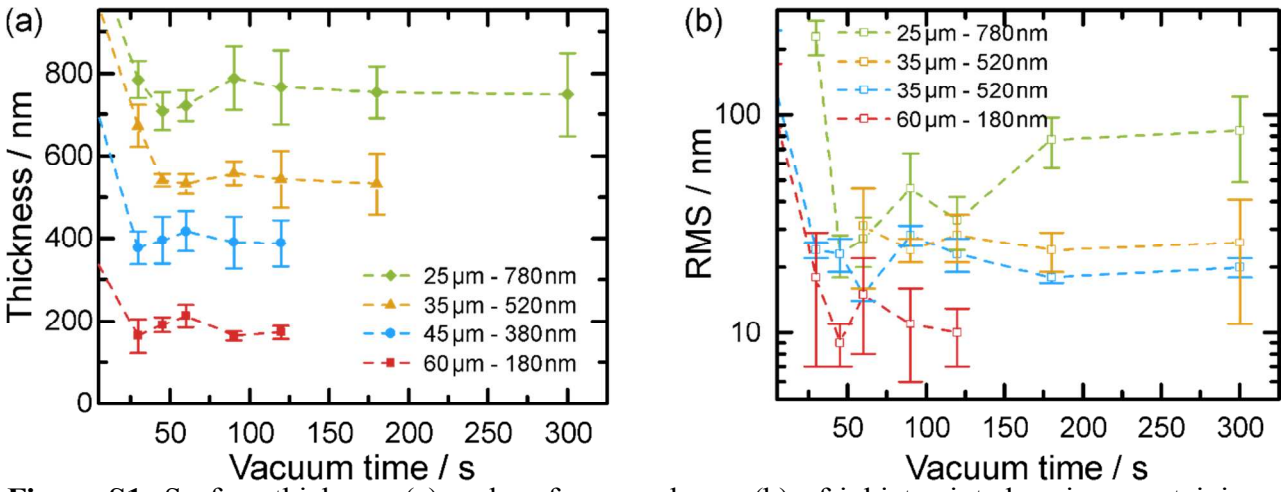

Figure S1: Surface thickness (a) and surface roughness (b) of inkjet-printed cesium containing triple cation perovskite absorber layer as a function of the vacuum time. Ink contains 0.75 M perovskite in a mixture of DMF:GBL:DMSO (3.5:3.5:3). Samples are printed on pretreated glass slides with a various drop spacings. Thickness is determined by profilometer measurements. The surface roughness is calculated form white light interferometer images.

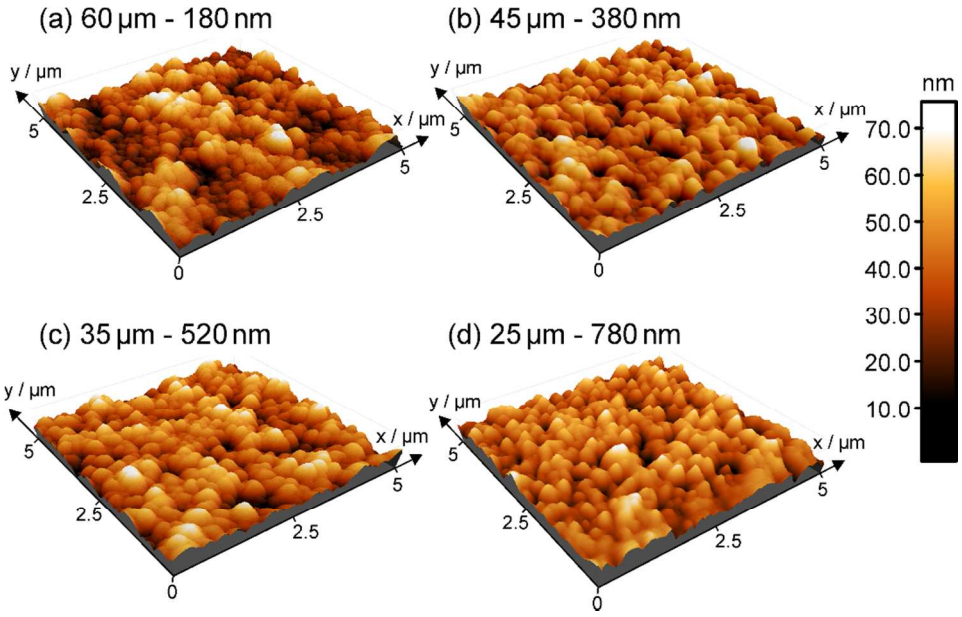

Figure S2: Atomic force microscopy (AFM) images (5µm x 5µm) of inkjet-printed cesium containing triple cation perovskite absorber layers with varying dropsspacings. Complementary to cross sectional SEM-images given in Figure 2.

Thickness vs. dropsspacing:

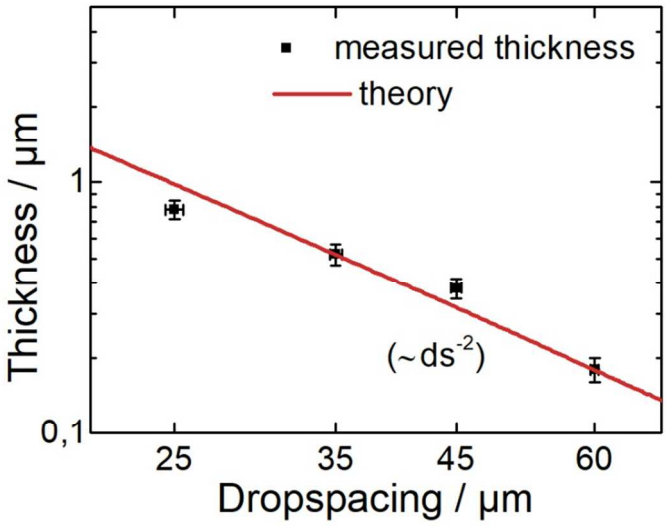

Figure S3: Thickness of the printed perovskite layers as function of the dropspacing. The black boxes show the measured thickness of the layers. The red line shows the theoretical dependency, where the thickness is inversely proportional to the square of the dropspacing (thickness~ds^{-2}).

Solar cell characteristics:

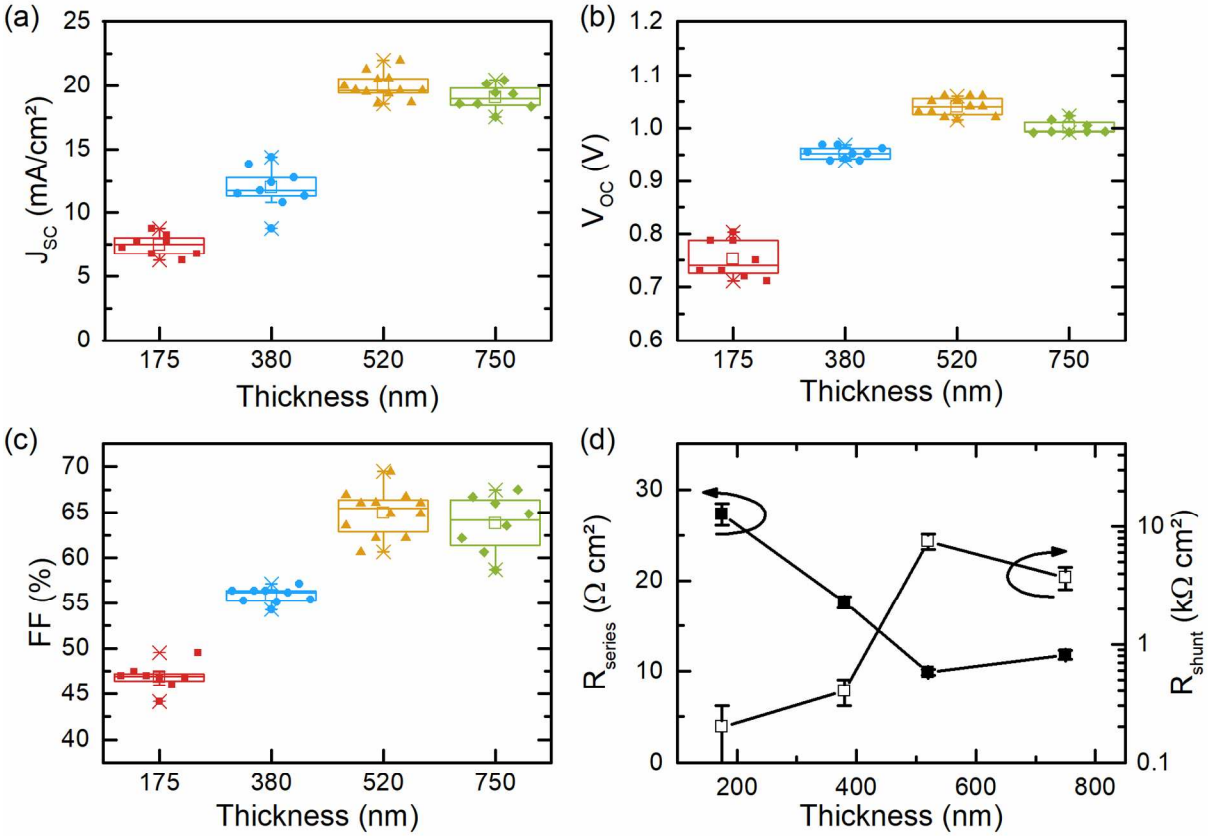

Figure S4: Complementary characteristics of the inkjet-printed triple cation PSCs shown in Figure3. (a) J_{SC}, (b) V_{OC}. (c) *FF* and (d) R_{series} and R_{shunt}.

All the devices show the literature known hysteresis effect in forward and backward measuring direction. Figure 3(a) depicts a solar cell device with a PCE of 14.0 % in backward direction and 9.4 % measured in forward direction. Nevertheless, by measuring the *EQE* of such a device we see that the calculated J_{SC} (18.6 mA/cm²) does fit reasonable well to the J_{SC} measured from the *J-V* characteristics with (19.9 mA/cm² and 19.7 mA/cm²).

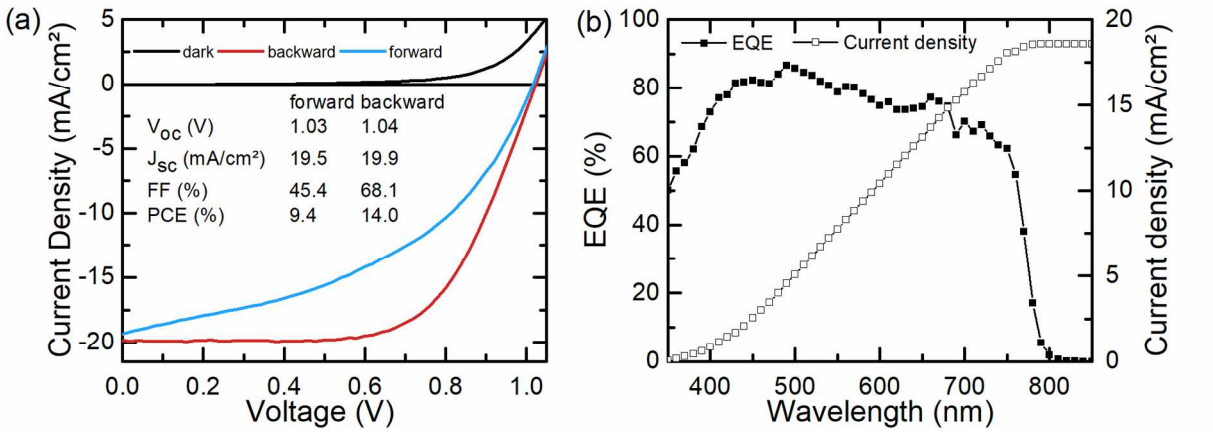

Figure S5: (a) *J-V* characteristics of a 520 nm thick printed perovskite solar cells, measured at 50 mV/s in forward and backward direction (from 1.1 V to -0.1 V). (b) Measured external quantum efficiency and extracted current density which matches quite good to the values given from the *J-V* curves.