Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary Information

Title: Rapid Composition Screening for Perovskite Photovoltaics via Concurrently Pumped Ultrasonic Spray Coating

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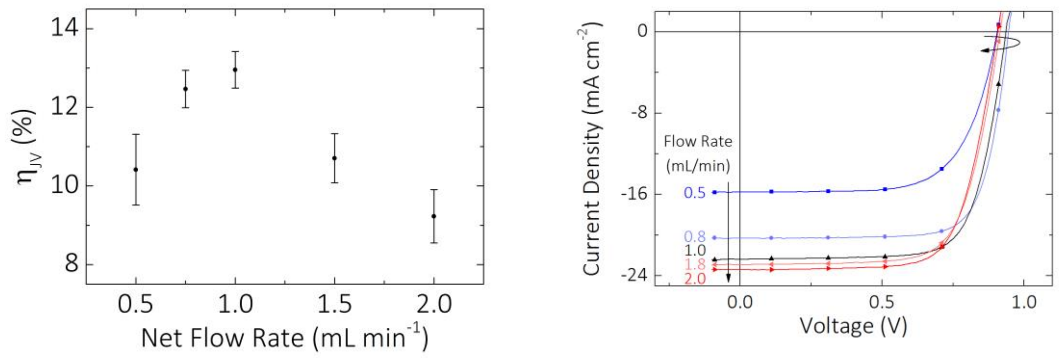

***Figure S1**. Initial power conversion efficiency (η) vs. total solution flow rate. All other deposition parameters were constant. The drying time was held constant for each deposition. We note that while the short circuit current density was high for the extremely thick devices, the trend is true.*

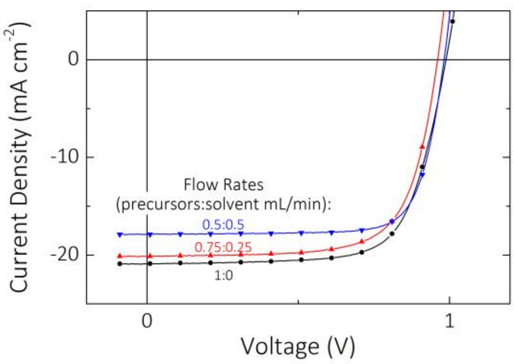

***Figure S2.** Current density vs. voltage plots for varied net concentration of the mixed ink. A concentrated precursor ink ($PbAc_2$/MAI) was concurrently mixed with neat solvent (DMF). All other deposition parameters were constant.*

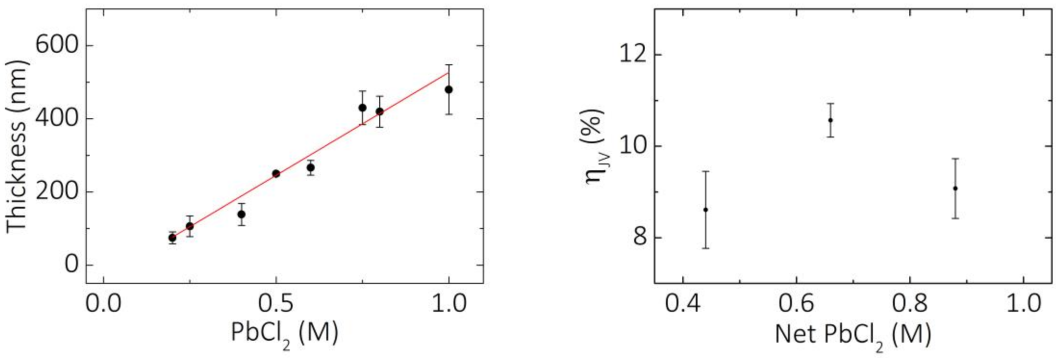

***Figure S3**. Controlling layer thickness via concurrently pumping of $PbCl_2$:MAI with neat solvent (DMF). This was done at several substrate temperatures, for optimal coating conditions. Thickness vs. net $PbCl_2$ concentration for all temperatures, and initial power conversion efficiency vs. concentration are shown. The net flow rate was held constant at 1 mL/min, as optimized in Figure S1.*

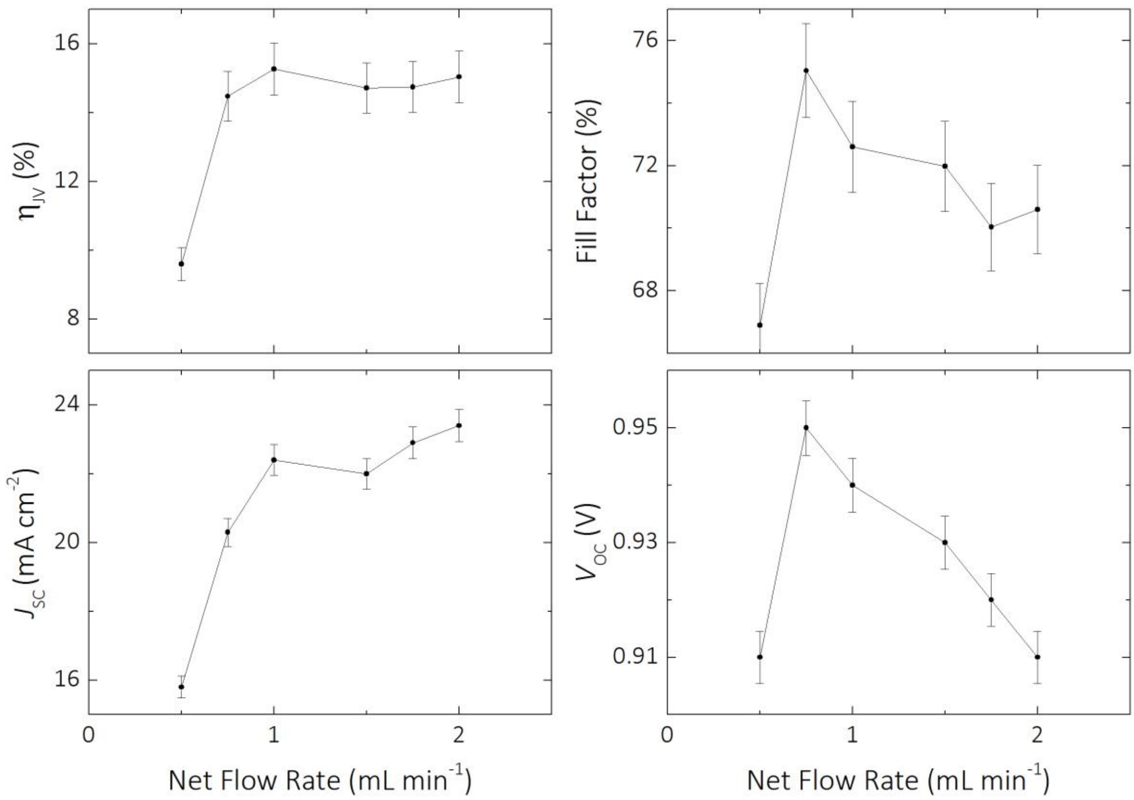

***Figure S4.** Efficiency (η), short circuit current density (J_{SC}), fill factor (FF), and open circuit voltage (V_{OC}) vs. the net flow rate for a constant concentration of $PbAc_2$/$PbCl_2$/MAI. Both drying time and layer thickness increase with flow rate. A line is added to guide the eye.*

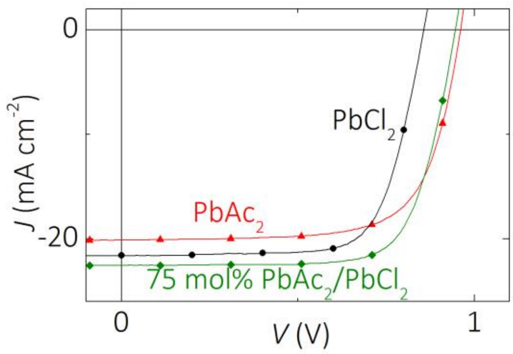

Figure S5*. Current density vs. voltage plot initially measured from the devices used for maximum power point tracking.*

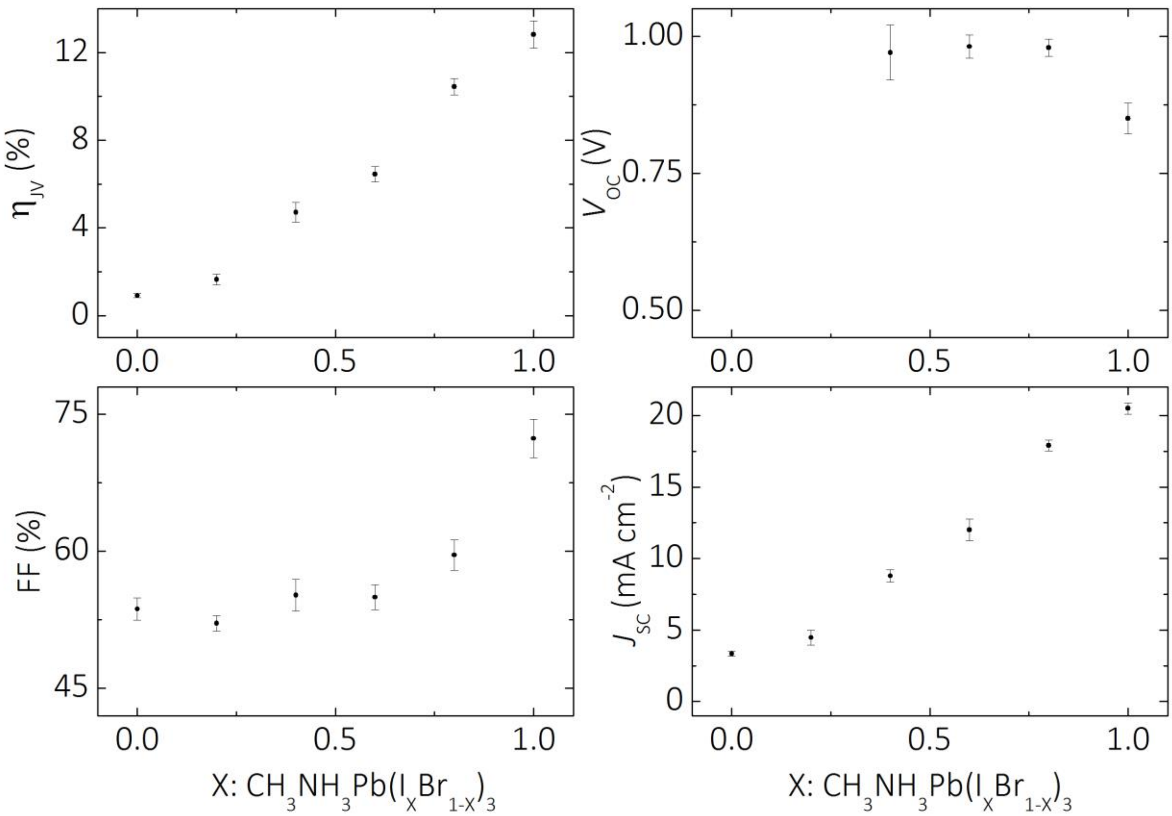

Figure S6*. Efficiency (η), short circuit current density (J_{SC}), fill factor (*FF*), and open circuit voltage (V_{OC}) vs. the molar concentration of I:Br.*

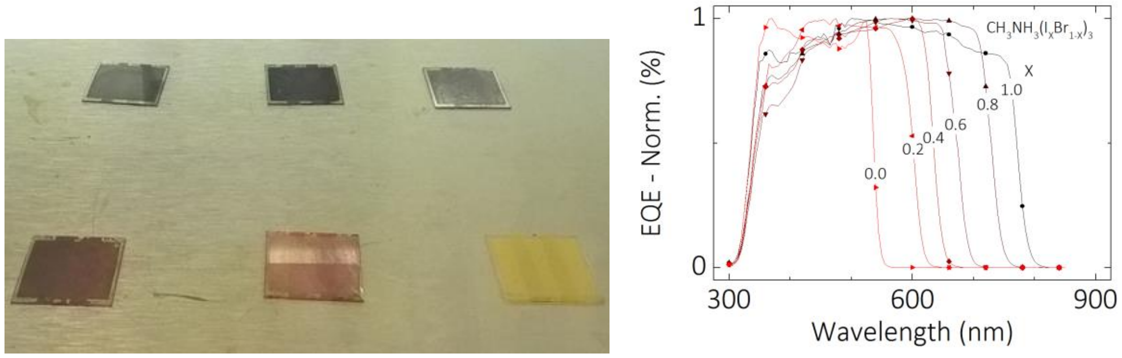

Figure S7. *Photograph of spray coated $CH_3NH_3(I_XBr_{1-X})_3$ layers, along with normalized EQE plots from devices.*

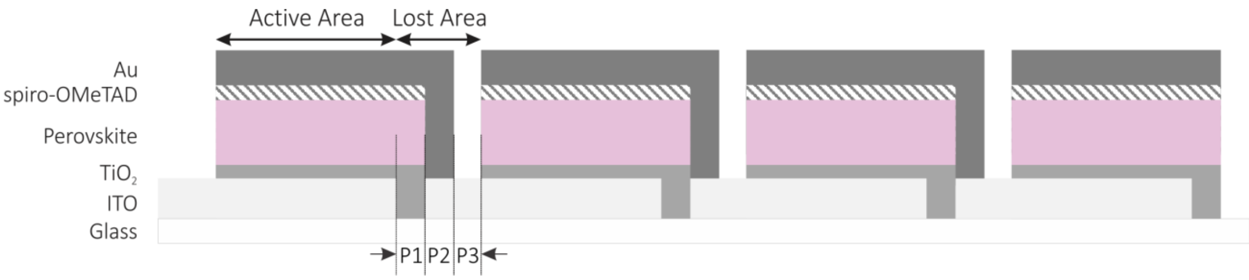

Figure S8*. Cross sectional schematic of the 4-cell module.*

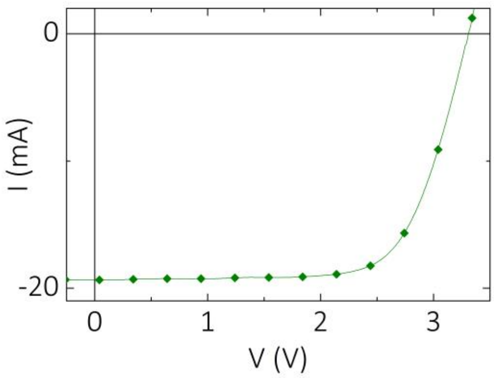

Figure S9*. Current density vs. voltage plot initially measured from the module used for maximum power point tracking.*