

Supporting information for

Elucidating the Charge Carrier Transport and Extraction in Planar Heterojunction Perovskite Solar Cells by Kelvin Probe Force Microscopy

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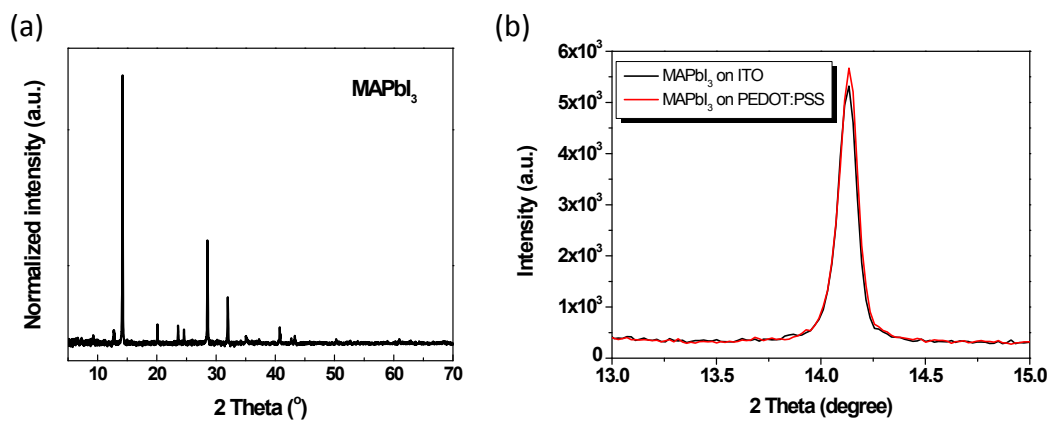


Figure S1. (a) XRD pattern of MAPbI₃ thin film with or without PEDOT:PSS interlayer. (b) (110) diffraction peak of MAPbI₃ thin film with or without PEDOT:PSS interlayer.

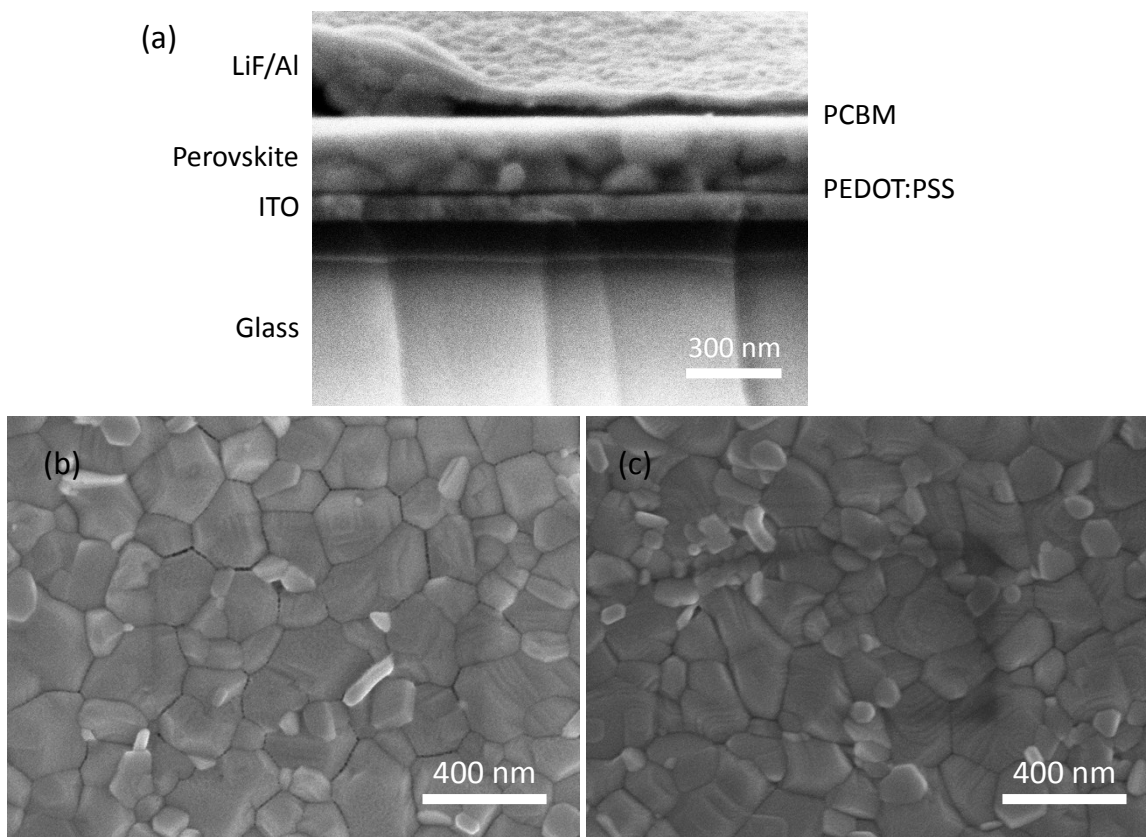


Figure S2. (a) Cross sectional image of perovskite thin films. (b-c) The SEM images of perovskite films deposited on ITO (b) and PEDOT:PSS (c).

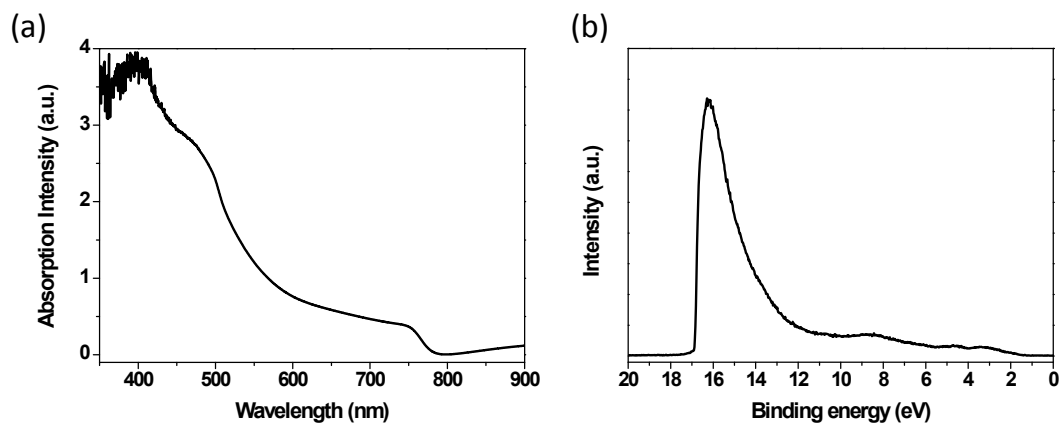


Figure S3. (a) UV-Vis absorption spectrum and (b) UPS spectrum of a MAPbI₃ thin film.

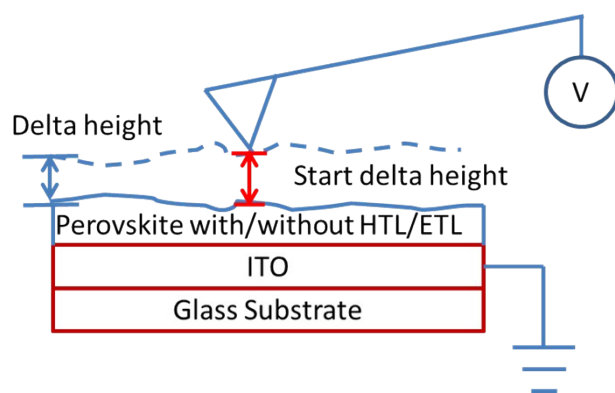


Figure S4. Experimental set-up for the KPFM measurement.

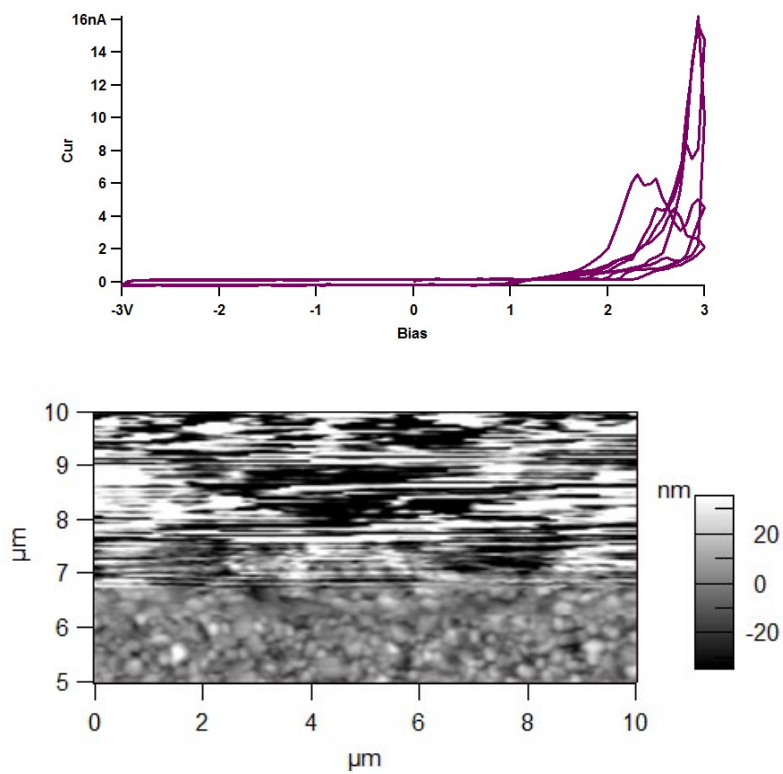


Figure S5. I-V curves and current image measured by C-AFM. The voltage is applied to the ITO. Hence, the applied positive sample bias is corresponded to the negative bias in PFM or KPFM mode.

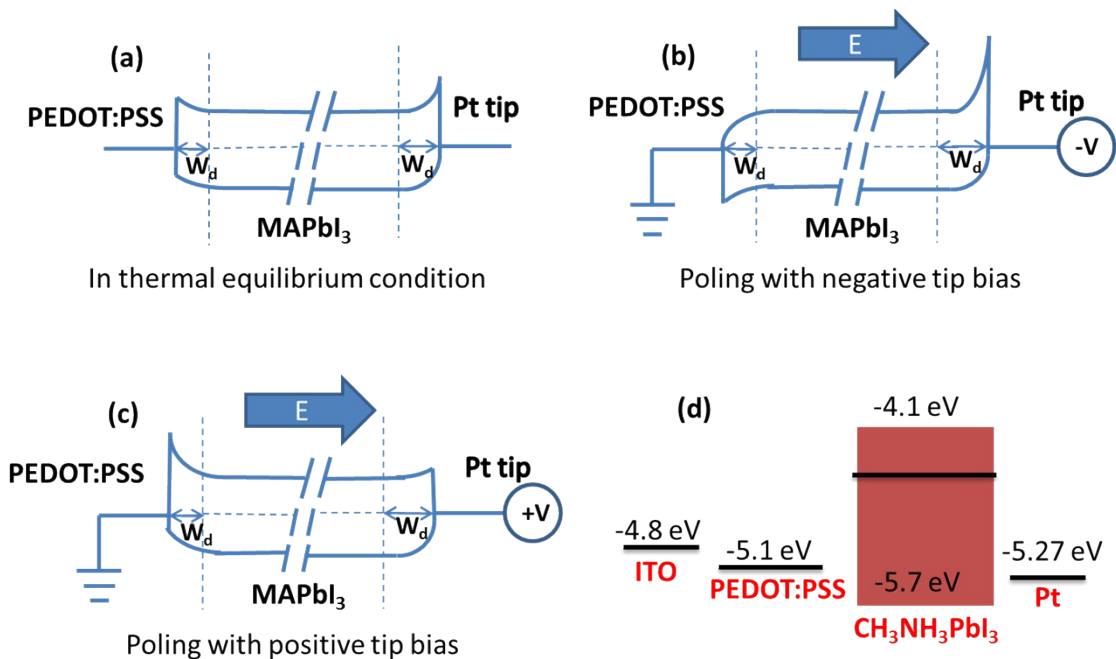


Figure S6. Schematic energy band diagrams and the Schottky barriers for PEDOT:PSS/MAPbI₃/Pt system: (a) in an ideal thermal equilibrium condition without external field; (b) when a negative bias is applied to the tip; and (c) when a positive bias is applied to the tip. In all of the figures, w_d indicates the width of the depletion region. (d) Energy band diagram of the measured structure.

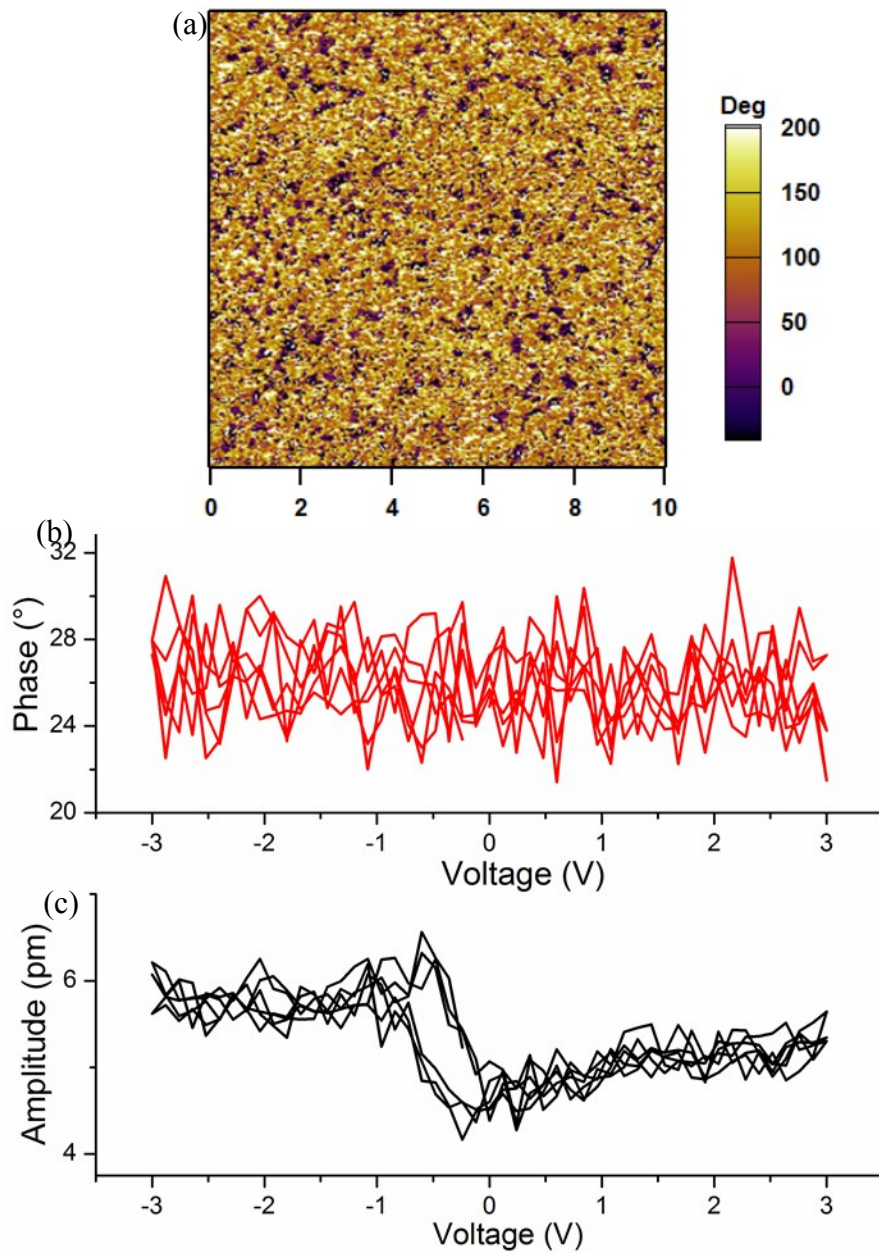


Figure S7. (a) PFM phase images of perovskite thin film under 250 W/m^2 illumination (light on) after the same DC poling process on the structure with both interlayer; (b) phase loops; and (c) amplitude loops.

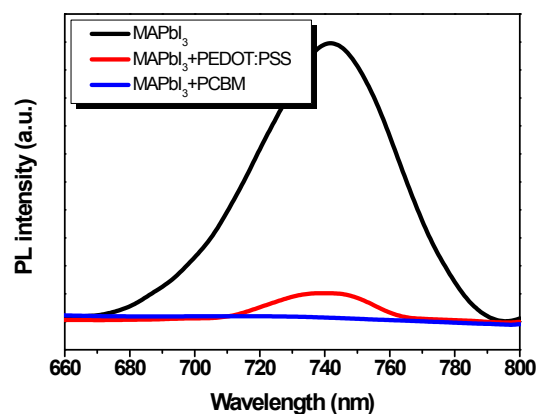


Figure S8. Steady-state PL spectra of MAPbI₃ without and with hole/electron transport interlayers.

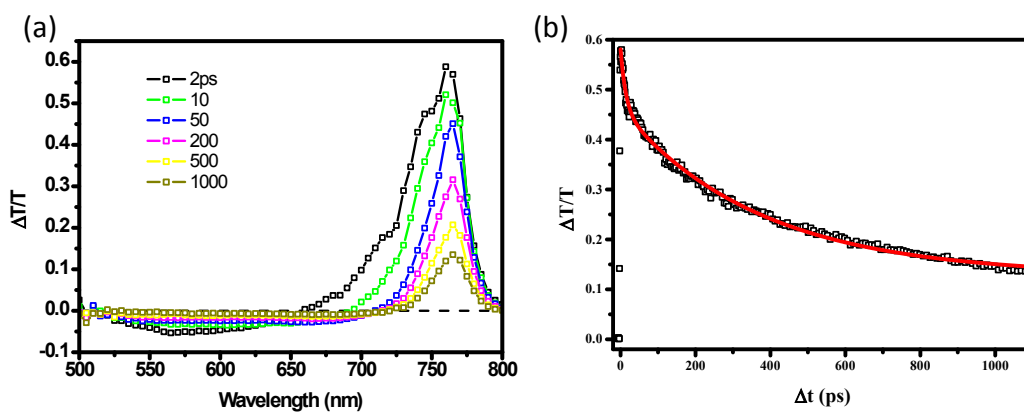


Figure S9. (a) Transient absorption spectrum. (b) Bleaching dynamics probed at 760nm on MAPbI₃ thin films.

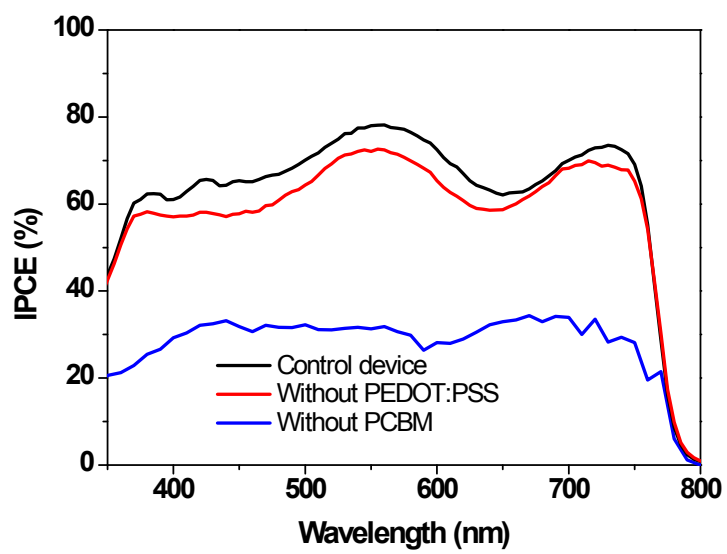


Figure S10. IPCE spectra of the solar cell devices processed with different conditions.