

Mo⁵⁺ doping induced interface polarization for improving performance of planar perovskite solar cells

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Abstract: In this paper, we investigated how interface-induced polarization affects the photovoltaic performance of hybrid perovskite solar cell (PSC) devices. The polarization of the hole transport layer (HTL) is regulated through incorporating metallic-like MoO_x into PEDOT:PSS. The common MoO₃ doped into PEDOT:PSS is used as a reference, and the device that used PEDOT:PSS-MoO_x as the HTL shows an enhanced J_{sc} and FF compared to the reference device. The open-circuit photovoltage decay and impedance spectroscopy measurements indicated that trap-assisted recombination is effectively suppressed at the interface between the hybrid perovskite and the PEDOT:PSS-MoO_x HTL, while severe trap assisted recombination takes place at the perovskite/PEDOT:PSS and perovskite/PEDOT:PSS-MoO₃ interface. We attribute these experimental findings to the fact that the incorporation of metallic-like Mo⁵⁺ into PEDOT:PSS enhances the conductivity of HTL and the interface polarization between PEDOT:PSS layer and perovskite, which helps to induce an interface polarization electric field to facilitate separation of charges and screen the recombination between the traps and free charges.

Key words: conductivity; hole-transporting layer; dielectric constant; polarization

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Supporting Information

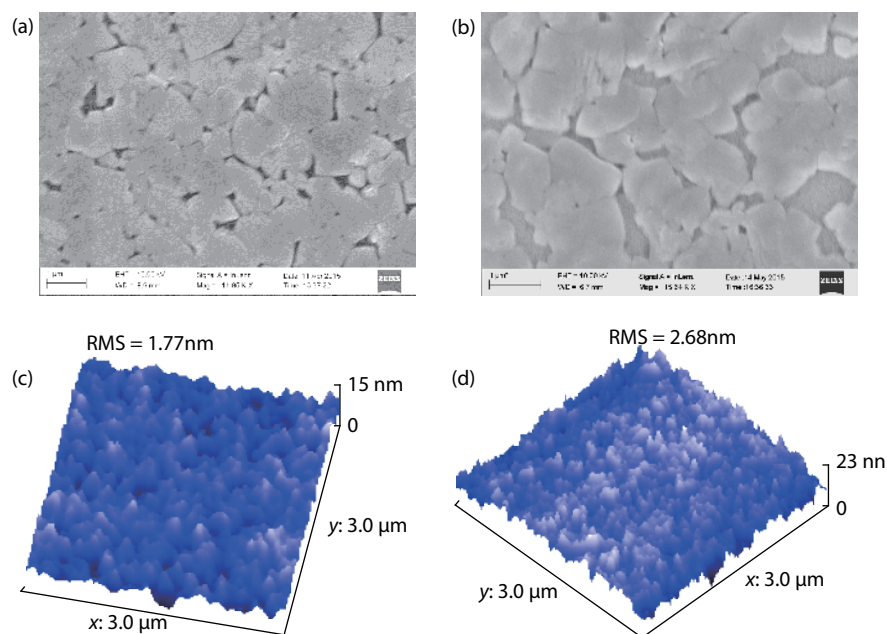


Fig. S1. (Color online) SEM images of perovskite layers on (a) the PEDOT:PSS-MoO₃, (b) PEDOT:PSS-MoO_x. The top view AFM images: (c) the PEDOT:PSS-MoO₃, (d) PEDOT:PSS-MoO_x.

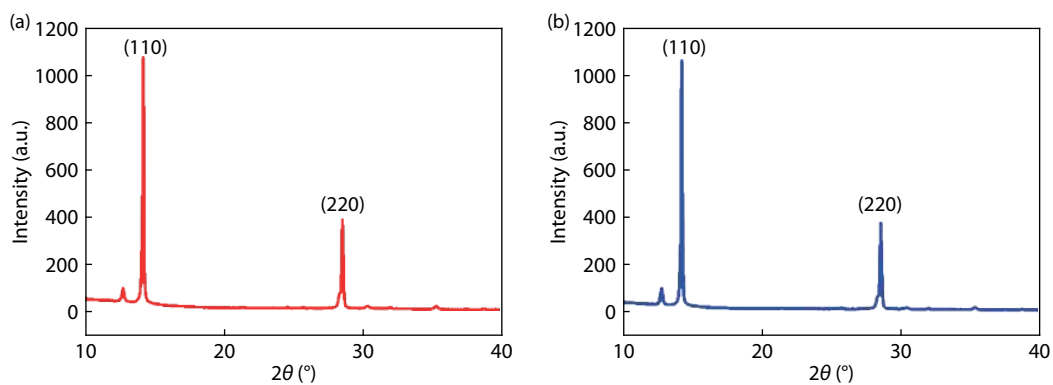


Fig. S2. (Color online) The identical XRD patterns of perovskite films on (a) the PEDOT:PSS-MoO₃ and (b) PEDOT:PSS-MoO_x.

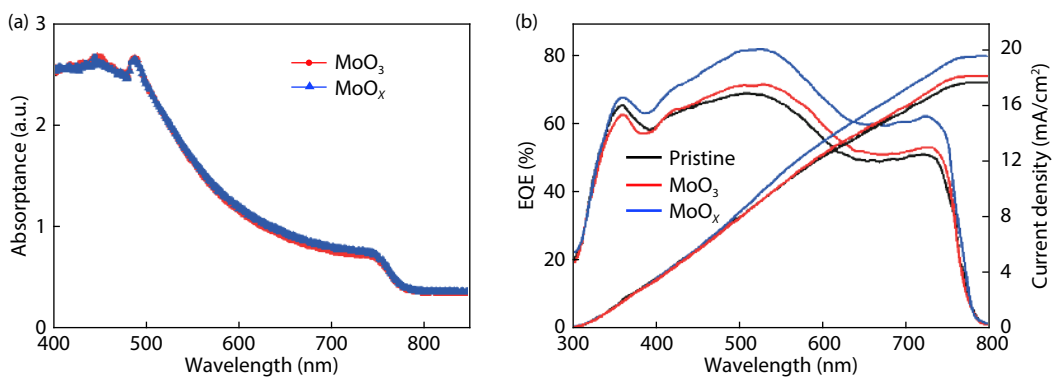


Fig. S3. (Color online) (a) Absorption of the perovskite on PEDOT:PSS-MoO₃ and PEDOT:PSS-MoO_x. (b) Incident photo-to-current conversion efficiency(IPCE) spectra of device based on the different HTLs.