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Influence of MoO_x interlayer on the maximum achievable open-circuit voltage in organic photovoltaic cells YUNLONG ZOU, RUSSELL HOLMES, University of Minnesota — Transition metal oxides including molybdenum oxide (MoO_x) are characterized by large work functions and deep energy levels relative to the organic semiconductors used in photovoltaic cells (OPVs). These materials have been used in OPVs as interlayers between the indium-tin-oxide anode and the active layers to increase the open-circuit voltage (V_{OC}) and power conversion efficiency. We examine the role of MoO_x in determining the maximum achievable V_{OC} in planar heterojunction OPVs based on the donor-acceptor pairing of boron subphthalocyanine chloride (SubPc) and C_{60}. While causing minor changes in V_{OC} at room temperature, the inclusion of MoO_x significantly changes the temperature dependence of V_{OC}. Devices containing no interlayer show a maximum V_{OC} of 1.2 V, while devices containing MoO_x show no saturation in V_{OC}, reaching a value of >1.4 V at 110 K. We propose that the MoO_x-SubPc interface forms a dissociating Schottky junction that provides an additional contribution to V_{OC} at low temperature. Separate measurements of photoluminescence confirm that excitons in SubPc can be quenched by MoO_x. Charge transfer at this interface is by hole extraction from SubPc to MoO_x, and this mechanism favors donors with a deep highest occupied molecular orbital (HOMO) energy level. Consistent with this expectation, the temperature dependence of V_{OC} for devices constructed using a donor with a shallower HOMO level, e.g. copper phthalocyanine, is independent of the presence of MoO_x.

Yunlong Zou
University of Minnesota

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