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Charge Accumulation and Internal Photovoltaic Processes in Organic Solar Cells HUIDONG ZANG, YU-CHE HSIAO, QING LIU, University of Tennessee, ILIA IVANOV, Oak Ridge National Laboratory, BIN HU, University of Tennessee — The accumulation of dissociated charge carriers plays an important role in reducing the loss occurring in open-circuit voltage (V_{oc}), short-circuit photocurrent (I_{sc}), fill factor (FF) in organic solar cells. We found from light-assisted capacitance measurements that the charge accumulation inevitably occurs at device interfaces in bulk-heterojunction ITO/PEDOT/P3HT:PCBM/Ca/Al solar cells. Our experimental studies have indicated that the charge accumulation can reduce the V_{oc} through charge injection, I_{sc} through charge collection, and FF through charge transport. Furthermore, our light-assisted capacitance measurements reveal that using a dielectric thin film of TiO_x can decrease charge accumulation in the ITO/PEDOT/P3HT:PCBM/ TiO_x /Ca/Al solar cell. In particular, we find that decreasing the charge accumulation can reduce the loss occurring in V_{oc} , I_{sc} , and FF. Clearly, controlling charge accumulation presents a new mechanism to improve photovoltaic performance in organic solar cells.

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