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The role of exciton ionization processes in bulk heterojunction organic photovoltaic cells YUNLONG ZOU, RUSSELL HOLMES, Univ of Minn - Minneapolis — Dissociating photogenerated excitons into their constituent charges is essential for efficient photoconversion in organic semiconductors. Organic photovoltaics cells (OPV) widely adopt a heterojunction architecture where dissociation is facilitated by charge transfer at a donor-acceptor (D-A) interface. Interestingly, recent work on MoO$_x$/C$_{60}$ Schottky OPVs has demonstrated that excitons in C$_{60}$ may also undergo bulk-ionization to generate photocurrent, driven by the built-in field at the MoO$_x$/C$_{60}$ interface. Here, we show that bulk-ionization processes also contribute to the photocurrent in bulk heterojunction (BHJ) OPVs with fullerene-rich compositions. The short-circuit current density ($J_{SC}$) in a MoO$_x$/C$_{60}$ Schottky OPVs shows almost no dependence on temperature down to 80 K. This characteristic of bulk-ionization allows the use of temperature-dependent measurements of $J_{SC}$ to distinguish dissociation by bulk-ionization from charge transfer at a D-A interface. For BHJ OPVs constructed using the D-A pairing of boron subphthalocyanine chloride (SubPc)-C$_{60}$, bulk-ionization is found to contribute $>10\%$ of the total photocurrent and $>30\%$ of the photocurrent from C$_{60}$. We further find that fullerene-rich SubPc-C$_{60}$ BHJ OPVs show a larger open-circuit voltage ($V_{OC}$) than evenly mixed BHJs due to the presence of bulk-ionization. This talk will examine the dependence of $J_{SC}$ and $V_{OC}$ on the relative fraction of dissociation by charge transfer and bulk-ionization processes.

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