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Conjugated block copolymers as model materials to examine charge transfer in donor-acceptor systems ENRIQUE GOMEZ, MELISSA APLAN, YOUNGMIN LEE, Pennsylvania State Univ — Weak intermolecular interactions and disorder at junctions of different organic materials limit the performance and stability of organic interfaces and hence the applicability of organic semiconductors to electronic devices. The lack of control of interfacial structure has also prevented studies of how driving forces promote charge photogeneration, leading to conflicting hypotheses in the organic photovoltaic literature. Our approach has focused on utilizing block copolymer architectures –where critical interfaces are controlled and stabilized by covalent bonds– to provide the hierarchical structure needed for high-performance organic electronics from self-assembled soft materials. For example, we have demonstrated control of donor-acceptor heterojunctions through microphase-separated conjugated block copolymers to achieve 3% power conversion efficiencies in non-fullerene photovoltaics. Furthermore, incorporating the donor-acceptor interface within the molecular structure facilitates studies of charge transfer processes. Conjugated block copolymers enable studies of the driving force needed for exciton dissociation to charge transfer states, which must be large to maximize charge photogeneration but must be minimized to prevent losses in photovoltage in solar cell devices. Our work has systematically varied the chemical structure, energetics, and dielectric constant to perturb charge transfer. As a consequence, we predict a minimum dielectric constant needed to minimize the driving force and therefore simultaneously maximize photocurrent and photovoltage in organic photovoltaic devices.

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