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Multiple Charge Transfer States at Ordered and Disordered Donor/Acceptor Interfaces MICHAEL FUSELLA, BREGT VERREET, YUN-HUI LIN, Princeton University, ALYSSA BRIGEMAN, The Pennsylvania State University, GEOFFREY PURDUM, YUEH-LIN LOO, Princeton University, NOEL GIEBINK, The Pennsylvania State University, BARRY RAND, Princeton University — The presence of charge transfer (CT) states in organic solar cells is accepted, but their role in photocurrent generation is not well understood. Here we investigate solar cells based on rubrene and C_{60} to show that CT state properties are influenced by molecular ordering at the donor/acceptor (D/A) interface. Crystalline rubrene films are produced with domains of 100s of microns adopting the orthorhombic phase, as confirmed by grazing incidence XRD, with the (h00) planes parallel to the substrate. C_{60} grown atop these films adopts a highly oriented face-centered cubic phase with the (111) plane parallel to the substrate. For this highly ordered system we have discovered the presence of four CT states. Polarized external quantum efficiency (EQE) measurements assign three of these to crystalline origins with the remaining one well aligned with the disordered CT state. Varying the thickness of a disordered blend of rubrene:C_{60} atop the rubrene template modulates the degree of crystallinity at the D/A interface. Strikingly, this process alters the prominence of the four CT states measured via EQE, and results in a transition from single to multiple electroluminescence peaks. These results underscore the impact of molecular structure at the heterojunction on charge photogeneration.

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