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Exciton dissociation at phthalocyanine-C_{60} interfaces S.W. ROBEY, G.J. DUTTON, NIST — Exciton dissociation and charge transfer processes occurring within 10's of nanometers of donor-acceptor interfaces are critical for the performance of organic photovoltaic (OPV) structures. We investigated fundamental issues of exciton dissociation near prototypical donor-acceptor interface using time-resolved two-photon photoemission (TR-2PPE). Phthalocyanine (Pc)-C_{60} interfaces with known structures were formed using organic molecular beam epitaxy. Pc $\pi \rightarrow \pi^*$ (Q-band) transitions were created by a sub-picosecond pump pulse, producing a population of singlet (S_1) Pc excitons. The dynamics of this population were then probed via photoemission by a time-delayed UV pulse. For CuPc\$C_{60}$ interfaces, the dynamics for excitons created far from the interface were modeled with a combination of vibrational or intraband relaxation plus intersystem crossing (ISC) to triplet levels. Relaxation leads predominantly to triplet (T_1) exciton levels on timescales of $\approx$ 1-2 ps. The decay dynamics of S_1 excitons excited in the CuPc layer adjacent to C_{60} were increased due to the additional channel leading to exciton dissociation, occurring with a rate of $\approx 7 \times 10^{12}$ sec^{-1}. However, excitons that relax to T_1 levels at the interface dissociate with a rate $\approx$ 500 to 1000 times slower, providing a picture of the energy dependence of exciton dissociation at this interface. The dependence of exciton dissociation versus Pc thickness at analogous H_2Pc \$C_{60}$ interfaces will also be presented. The results indicate that, for this interface, exciton dissociation is much faster for the interfacial layer with dissociation from the 2^{nd}, and subsequent layers of H_2Pc, reduced by at least a factor of 10.

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