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Real-Time X-ray Probing of Photoinduced Charge Generation in a Metal-Organic Heterojunction[1] OLIVER GESSNER, Lawrence Berkeley National Laboratory, FRIEDRICH ROTH, TU Bergakademie Freiberg, MARIO BORGWARDT, JOHANNES MAHL, Lawrence Berkeley National Laboratory, WOLFGANG EBERHARDT, Center for Free-Electron Laser Science / DESY — Photoinduced charge generation plays a central role in a broad range of physical, chemical, and biological processes that underlie natural and engineered photocatalytic and photovoltaic systems. The inherent complexity of most of these systems, however, makes a direct determination of the fundamental photon-to-charge conversion mechanisms on their natural time- and length-scales challenging. We employ femtosecond time-resolved X-ray photoelectron spectroscopy (TRXPS) at the FLASH free electron laser to study the photoinduced emergence of free charge carriers in a planar heterojunction consisting of a copper-phthalocyanine (CuPc) donor and a C60 acceptor phase. The elemental and chemical sensitivity of TRXPS enables a direct quantification of the timescale and efficiency for the separation of interfacial charge transfer (ICT) states into separate charges, as well as the competing loss channel of ICT recombination in a single, interfacial site-specific measurement. Implications for the achievable light harvesting efficiency of the specific heterojunction and, more generally, for evaluating such efficiencies by complementary techniques are discussed.

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