

Abstract Submitted  
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**Photoinduced charge carrier dynamics at a dye-semiconductor interface probed by picosecond time-resolved X-ray photoelectron spectroscopy**<sup>1</sup> JOHANNES MAHL, STEFAN NEPPL, HENDRIK BLUHM, OLIVER GESSNER, Lawrence Berkeley National Laboratory — We investigate laser-induced charge carrier dynamics at the interface between N3 dye molecules and a film of nanocrystalline ZnO using picosecond time-resolved laser pump-synchrotron probe X-ray photoelectron spectroscopy. Pumping the sample with 532nm light pulses induces HOMO – LUMO excitations in the dye followed by electron injection into the ZnO conduction band. The subsequent electronic dynamics are marked by an interplay between transient charge carrier densities, corresponding interfacial potentials, and electron-hole recombination rates. Monitoring the picosecond dynamics of a dye-associated photo-line (C1s) and a substrate-associated photo-line (Zn3d), we find that both exhibit transient rigid shifts, but with different amplitudes and different dynamic trends. The difference between these trends can be described by a bi-exponential decay with time constants of 400ps and around 20ns while the absolute shifts of both individual photo-lines decay on partly much longer timescales (tens to hundreds of nanoseconds). These results demonstrate how the element specificity of inner-shell transitions may be employed to gain a local perspective of photo-induced charge carrier dynamics from both sides of the interface. The findings will be discussed within the framework of charge-injection-induced band dynamics and transient interfacial dipoles.

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