ULTRAFAST ENERGY TRANSFER AND STRUCTURAL DYNAMICS OF THE ORGANIC POLYMER ON AN MoS_2 MONOLAYER

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Energy transfer across a heterogeneous interface is an important topic to understand detailed functioning mechanisms of solar cells. Here, we used mega-electronvolt ultrafast electron diffraction (MeV UED) as a sensitive time-resolved ”thermometer” to simultaneously measure structural dynamics and energy transfer between a polymer (PTB7) and an atomic thin MoS_2 monolayer. Optical excitation of the polymer at 700 nm induces a short-lived temperature jump that relaxes quickly through the heterojunction interface to the monolayer MoS_2. The thermal energy transfers from the polymer to the atomic layer is described by the thermal transport model. The time-resolved structural dynamics of polymer suggests a bond dissociation located specifically at the C-O sidechain during the flattening motion of the two aromatic conjugated rings in the excited state, providing the fundamental mechanism of the photo-instability of a polymer in the applications of solar cell materials.

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