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Electronic properties of interfaces with conjugated oligo- and polymers

The project focuses on oligo- and polymer interfaces that are of *direct relevance* for organic photovoltaic cells (OPVCs), their function and efficiency. Our goal is to provide a complete understanding of the energy levels and charge carrier dynamics at interfaces that occur in vacuum-processed smallmolecule as well as polymer/polymer heterojunction photovoltaic cells (i.e., donor/anode and donor/acceptor interfaces) and how these energy levels influence the OPVC energy conversion efficiency. These interfaces comprise new oligothiophene derivatives available through the cooperation with the Bäuerle group (Uni Ulm) as well as polythiophene-based donor polymers and diimide-based acceptor copolymers available through collaboration with the Scherf group (Uni Wuppertal) within this priority program. Using oneand two-photon photoemission (2PPE) spectroscopy the relevant properties that determine the open circuit voltage (i.e., donor/electrode work function, offset of donor and acceptor HOMO levels, offset of donor and acceptor LUMO levels; offset between the donor HOMO and acceptor LUMO level) of small-molecule based organic solar cells will be deter-mined. In addition time-resolved 2PPE provides access to the charge carrier and exciton dynamics at interfaces. Second harmonic generation (SHG) is utilized to investigate the corresponding properties in polymer/polymer heterojunctions. These values will be used, in combination with OPVC characterization, to test existing device models, and to provide a reliable parameter base for improved understanding of device function. This work is per-formed in close cooperation with the projects of Leo/Bäuerle (Uni Dresden/Uni Ulm) and Neher/Scherf (Uni Potsdam/Uni Wuppertal) employing the same semiconducting oligo- and polymers for OPVC fabrication and characterization. These concerted efforts will provide elementary physical properties of oligo- and polymer interfaces and full characterization of OPVCs and will thus lead to a significant advance in the understanding of elementary processes of organic photovoltaics.