

Charge Photogeneration and extraction in polymer: fullerene bulk heterojunction organic solar cells

This project aims at gaining a profound understanding of the processes that determine the photovoltaic efficiency of novel polymer:fullerene systems beyond the well-studied reference system P3HT:PCBM. In particular the polymers C-PCPDTBT and Si-PCPDTBT, as well as some novel highefficiency benzodithiophene-based copolymers, will be studied. The research team will perform various kinds of experiments including steady-state and transient experiments such as i.) biasdependent transient pump-probe spectroscopy, ii.) field-dependent time-resolved photoluminescence experiments, iii.) time-delayed collection field experiments, iv.) (time-delayed) time-offlight (TOF) and v.) photo-CELIV experiments.

These experiments are supposed to directly observe the effect of an electric field on the early-time (fs-ns) charge generation dynamics and (geminate) recombination dynamics as well as on the (non-geminate) charge recombination and extraction dynamics on a timescale from nano- to milliseconds.

The results of the experiments will be compared to theoretical studies of the interfacial exciton dissociation process and microscopic simulations of charge diffusion. Furthermore, the experimentally obtained parameters will be entered into macroscopic device simulations to compare the predicted JV-curves with the experimentally obtained ones in order to evaluate the quality of the calculations and modelling approaches.