

Summery

The proposed renewal project is based on a very fruitful cooperation between the three groups in the last 2 years supported by SPP 1355 program. The results of photovoltaic performance investigation of thiophene dendrimer-based BHJ solar cells as well as morphology analysis and modeling on P3HT:ZnO solid films, obtained so far, serve as a basis for the continuation of the project. In this renewal proposal, the objective of this interdisciplinary research project is to develop novel three dimensional conjugated oligothiophene dendrimers as organic semiconductors for applications in solution-processed bulk-heterojunction solar cells, and utilize these three dimensional monodisperse organic nano-objects as model compounds to investigate the elementary physical processes in bulk heterojunction solar cells. In particular, the understanding of the role of nanoscale phase on device performance, including charge generation, transportation and collection will be addressed in detail. Nanoscale phase separation of dendrimer:PCBM or dendrimer:ZnO blended films will be investigated by microscopic technologies, such as scanning probe and transmission electron tomography. Mathematical models will be developed for analyzing, describing, and simulating the morphology of the blended films. Furthermore, solar cell device models that describe absorption of light, diffusion of excitons, charge generation and charge transport within disordered nanoscale bulk heterojunction blends of donor and acceptor materials will be developed and used to describe and understand the performance of oligothiophene dendrimer solar cells.