Summary

The proposed work aims at the understanding and the advancement of the photovoltaic properties of organic solar cells with all-polymer active layers. Novel “low bandgap” electron-accepting copolymers of high molecular weight polymers will be synthesized. The HOMO and LUMO energy levels of these copolymers are designed for a combination with well-established electron-donating polymers such as poly(3-alkylthiophene) (P3HT) or poly(2,3’’’’-dialkylquaterthiophene) (PQT). The field-dependence of charge carrier photogeneration in these donar-acceptor couples will be investigated by performing studies on polymer-polymer bilayer devices which are fabricated via the so-called interlayer approach. To investigate the effect of the LUMO offset on the photogeneration, alternating copolymers with different LUMO energies will be generated and combined with P3HT. In addition, copolymers with incresasing energetic disorder will be generated by switching from alternating to random copolymers. Photovoltaics studies on these copolymers will address the question if energetic disorder assists the photogeneration of free carriers. Finally, the influence of additives as block copolymers or low molecular weight softeners (and surfactants) on the morphology of polymer-polymer blends will be investigated, with the goal to develop novel approaches towards polymer blends with high charge carrier extraction efficiencies.