Summery

The goal of the present project is to gain synthetic control over the π−π stacking ability of low band gap poly(p-arylene-ethynylene)-alt-poly(p-arylene-vinylene)s based copolymers. This is attained through grafting of linear and/or branched alkoxy side chains. Special emphasis will be laid on side chain based statistic block-copolymers consisting of sequences of linear as well as branched side chains randomly distributed within the conjugated backbone. The aim is to establish a correlation between the π−π-stacking ability of the polymers, the electronic and photophysical properties of the polymers and polymer-fullerene photo-active layers, the nanoscale morphology of the latter up to the photovoltaic performance of the solar cells. The nano-scale phase separation in the active layers will also be tuned by using mixture of solvents for film preparation as well as by changing the solubility of different fullerene derivatives. The morphology will be investigated over a broad length scale range by atomic force microscopy, scattering methods and optical microscopy. We will implement new spatially- and time-resolved scattering methods which allow monitoring morphological changes such as self-assembly and phase separation during real printing and annealing processes online. In order to gain knowledge about the long-term stability of the materials we will perform photo-degradation studies and solar cell lifetime investigations.