Summery

The project is an interdisciplinary approach combining chemistry and interface science (Ludwigs) and device engineering (Würfel) to study the influence of highly ordered nanostructures within semiconducting polymer/inorganic hybrid solar cells. Thiophene based polymers and nanosized ZnO will be used as model system. Highly interdigitating donor/acceptor networks with dimensions on the scale of the exciton diffusion length will be tailor-made to achieve both a high interfacial area between the donor and the acceptor and a minimization of the transport pathlengths of the charge carriers to the electrodes. In a first approach, the influence of electric fields and controlled solvent vapor atmospheres on the alignment of ZnO nanorods within a matrix of semiconducting polymer will be studied in-situ on interdigitated nanoelectrode arrays. In a second approach, highly ordered 2 arrays of ZnO and polymer nanorods will be prepared by block copolymer self assembly and sol-vent-aided nanoimprint lithography, respectively. These templates will subsequently be infiltrated with the complementary component. Novel solar cell design principles and variation of electrode materials will be used to engineer the semiconductor/electrode interfaces. The influence of ordered morphologies on the transport of charge carriers and the overall device performance will be elucidated with various characterization methods. Optical and electrical modelling of solar cells shall provide deeper insight in the device physics and evaluate the optimization potential of different morphologies.