Summary

This project is an interdisciplinary approach to control assembly and achieve better understanding of nanohybrid solar cells based on inorganic nanoparticles and functional polymers via combining chemistry, surface physics and device engineering. The functional hierarchy, i.e. interplay of components on different length scales, will be addressed within the photovoltaic device: On the molecular scale, size and shape tuned surface-functionalized nanoparticles will be manufactured in order to allow superior dispersion with the polymeric component. On the mesoscopic scale, interface mediated nanostructure formation will be applied to the photoactive layer. In order to achieve intimately connected donor/acceptor composites exhibiting continuous pathways for the charge carriers we propose to use electrospinning as one promising approach. On the device level, semiconductor/electrode interfaces will be engineered by means of novel solar cell design principles and variation of electrode materials. New electrical characterization methods will be developed on the nm and μm scale to clarify the complex interplay between the nanomorphology and the optoelectronic functionality of the device. In order to identify the optimization potential of the photovoltaic system, optical and electrical modelling of solar cell devices will be carried out along with the experiments. As a model system we will use nano-particulate ZnO and poly(3-hexyl thiophene).