

Dr. Sabine Ludwigs
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Functional Materials for Energy Harvesting

In my interdisciplinary research team of physical and macromolecular chemists we are working on the synthesis and the morphological and electrochemical characterization of novel tailor-made polymers and nanomaterials with potential applications in the photoactive layer of organic solar cells.

Synthesis & Characterization

On the molecular scale we are synthesizing novel functional, conjugated polymers, inorganic semiconducting nanoparticles and block copolymers. This work is conducted in collaboration with Prof. R. Mülhaupt, University of Freiburg, at the Institute for Macromolecular Chemistry and the Freiburg Materials Research Center.

Applied Electrochemistry

We use cyclic voltammetry combined with in-situ conductance measurements and in-situ spectroscopy to study conductivity and charge transport mechanisms of conducting polymers and nanomaterials. A strong collaboration with Prof. J. Heinze, University of Freiburg, is established.

Additionally, electroplating is applied to synthesize inorganic materials within nanoporous templates. One particular example is the growth of ZnO within cylindrical and gyroidal nanoporous templates made by block copolymer self-assembly.

Control of nanomorphologies

Dr. Ludwigs has extensive experience in the manipulation and control of nanomorphologies in thin films. The use of specific methods such as surface manipulation, special solvent treatment, top-down methods, such as nanoimprint lithography, and electric fields to align nanoscale structures is part of her scientific expertise.

During her diploma thesis (2002) and PhD thesis (2004) Dr. Ludwigs systematically studied the fundamentals of microdomain formation of amorphous ABC triblock copolymers in bulk, solution and in thin films.

During her postdoc time in the Cavendish Laboratory in Cambridge Dr. Ludwigs started working on nanostructured hybrid materials with potential use in polymer solar cells. One project involved the synthesis of cylinder-forming poly(lactide-*block*-poly(fluorostyrene) block copolymers. Upon alignment of the block copolymer domains perpendicular to the interfaces with electric fields and subsequent removal of the polylactide block with soft chemistry techniques, nanoporous templates could be generated.

Selected publications:

Self-assembly of functional nanostructures from ABC triblock copolymers, S. Ludwigs et al. Nature Materials 2003, 2, 744.

Free-standing nanowire arrays from soft-etch block copolymer templates, E.J.W. Crossland et al. Soft Matter 2007, 3, 94.

Short CV of Dr. Ludwigs

1997 – 2002	Studies of Chemistry at the University of Bayreuth, Germany; Diploma thesis on synthesis and bulk phase behaviour of triblock copolymers; Group of Prof. G. Krausch	Awards / Funded projects: - 2007 / 2008: Invited professorship at the ECPM, University of Strasbourg - 2007: Participation at the CERC3-Young Chemists' Workshop on „Organic Solar Cells“ - Funding by the Elite program of the Landesstiftung Baden-Württemberg, starting April 2008
2002 – 2004	PhD-thesis, Subject: „Complex nanostructures in ABC triblock terpolymer thin films“, University of Bayreuth, Germany	
2004 – 2006	Postdoc at the Cavendish Laboratory, University of Cambridge, UK; Group of Prof. U. Steiner	
since 10/06	Group leader at the Institute for Macromolecular Chemistry & Freiburg Materials Research Center, Freiburg, Germany	