Universität Basel

Research Project

Polymers Comprising Concave and Chiral Subunits for the Selective Dispersion of Single Walled Carbon Nanotubes (SWCNT)

Third-party funded project

Project title Polymers Comprising Concave and Chiral Subunits for the Selective Dispersion of Single Walled Carbon Nanotubes (SWCNT)
Principal Investigator(s) Mayor, Marcel ;
Co-Investigator(s) Kappes, Manfred ;
Project Members Bodoky, Ina ;
Organisation / Research unit
Departement Chemie / Molecular Devices and Materials (Mayor)
Department
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Single wall carbon nanotubes are promising materials for future devices due to their outstanding physical properties. In particular their electronic and optical features make them promising functional units in numerous applications. While the correlation between their structure (n,m indices) and physical properties is well understood, their integration into devices and materials suffers from both the poor availability of pure samples and the limited processability of these substances. Within this proposal we strive to develop polymeric structures able to selectively disperse SWCNTs with well defined physical features like electronic properties, diameter, n,m-indices and even chirality. For that purpose concave building blocks with favorable p-stacking interactions with bent SWCNT surfaces shall be developed and integrated in various (co)-polymers. These building blocks will be synthesized as racemates which will be separated into pure enantiomers (by separating the diastereomers obtained from both enantiomers). The approach will thus make (co)-polymers of enantiomerically pure building blocks available. These (co)-polymers will be used to disperse HiPco-SWCNTs and the composition of the dispersion (as well as the polymer SWCNT interaction) will be analyzed by optical methods like UV-vis-nIR absorption , nIR photoluminescence-, and Raman spectroscopy. We also aim at developing a process enabling the reversible coating of SWCNTs by polymers. While the dispersing coating provides perfectly processable tubes, the residual insulating coating effects the interaction of the tube with the substrate upon integration. By profiting from the reversibility of Diels-Alder reactions we design coating polymers which can be thermally decomposed into small building blocks. Thereby we hope to provide coatings providing processability which can be removed after integration of the tube in UHV applications. We will correspondingly investigate the polymers thermal decomposition on the SWCNTs in situ, using both desorption mass spectrometry, Raman microscopy and a variety of surface analytical methods to probe the resulting materials. This will also provide feedback for the optimization of the polymer structure for the purpose of obtaining UHV clean chiral vector selected SWCNT materials for further studies.

Keywords Diels-Alder polymers, tailor-made polymers, selective dispersion, single wall carbon nanotube, chiral polymers, surface science, Raman spectroscopy , thermal desorption mass spectrometry
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