Universität Basel

Research Project

Synthetische Nanoskalige Objekte - Bausteine von funktionalen Materialien und von Funktionseinheiten

Third-party funded project

Project title Synthetische Nanoskalige Objekte - Bausteine von funktionalen Materialien und von Funktionseinheiten
Principal Investigator(s) Mayor, Marcel ;
Organisation / Research unit
Departement Chemie / Molecular Devices and Materials (Mayor)
Department
Project start 01.04.2015
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Status Completed

The proposal follows the future SNF rules of one project per applicant in division II. It is divided in five subprojects, each being the subject of a PhD thesis. Even though these five topics have very different aims, they have in common that current challenges in nano-technology are tackled by bottom-up assembly of functional molecular structures by organic synthesis. The five subprojects are: (I) Helical Oligomers, (II) Molecular Junctions, (III) Electrode Functionalization, (IV) Coated Nanoparticles, and (V) Supramolecular Preorganized Reactants. (I) Helical Oligomers: Molecular rods resembling a “molecular screw” will be developed. They consist of two interlinked oligomers with different spacing of the repeat unit, resulting in the helical wrapping of the longer oligomer around the shorter one which acts as axis. These appealing helical architectures are particular interesting due to their chiroptical properties and as model compounds to investigate molecular racemization mechanisms. (II) Molecular Junction: Molecular rods as functional units of carbon nano-tube (CNT) based molecular junctions will be synthesized. Model compounds enabling single molecule electroluminescence experiments with a central Ir(III) terpy as emitting subunit will be investigated. A molecular turnstile responding on the applied electric field shall be assembled and investigated in CNT-junctions. Interestingly the mechanical switching should be detectable in the junction’s transport characteristic. (III) Electrode Functionalization: An electrochemically addressable acetylene protection group shall be developed, enabling to differentiate between electrodes by their electrification. The working principle will be investigated in solution as well as on electrodes by in situ functionalization of the deprotected acetylene groups by alkyne-azide “click” chemistry. (IV) Coated Nanoparticles: As continuation of our studies providing mono-functionalized gold particles in good yields, new motives for thioether based olgomers as multidentate macromolecular ligands shall be investigated. The focus is set on making processible gold nanoparticles with diameters of 2 nm and larger in order to increase their attractiveness for sensing applications based on optical read outs. (V) Supramolecular Preorganized Reactants: Supermolecules are used to spatially arrange molecular building blocks which are subsequently covalently interlinked. Examples of various dimensions are investigated ranging from a small (0-d) caged Fe(II) terpy complex to tune its spin state in transport experiments, over mechanically interlinked daisy chain oligomers (1-d) to interwoven 1-d polymers resembling a “molecular textile” (2-d) which shall be obtained by preorganizing the building blocks in metal organic framework.

Keywords Molecular Electronics, Self Assembly, Supramolecular Chemistry, Molecular Device, Nano Chemistry, Organic Chemistry, Hybrid Materials
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