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Titre/Title | From «Geländer» Architectures to Mechanosensitivity

Résumé/Abstract | by the group of Marcel Mayor at the Department of Chemistry of the University of Basel (Switzerland) and the Institute of Nanotechnology (INT) of the Karlsruhe Institute of Technology (KIT, Germany) in collaboration with numerous collaborating teams in experimental Physics and/or Physical Chemistry.

Helical chiral π-systems can be classified by the spatial relationship between their aromatic subunits and their axles[1]. The atrop isomerization of (1,1')-bi-phenyl systems stabilized by additional alkyl bridges interlinking the 2,2' positions[2,3], awoke our interest in the stabilization of helically arranged π-systems. The dimensional mismatch of two tightly fixed oligomer chains was predicted to result in the helical wrapping of the expanded subunit around the more compact one. And indeed, in a first model compound, the longer benzylic ether oligomer entwined helically around the oligophenyl back-bone[4,5]. The influence of the interlinking heteroatom in the benzylic ether on the extent of helicity was studied[6]. In the next step, we even got rid of the heteroatoms. These first all carbon «Geländer» structures consist of a para-ethanyl-phenyl subunit fixed to a para-terphenyl backbone[7]. Sulfone bridged «Geländer» architectures not only provided insight about the parameters controlling the racemization barrier[8], but also gave access to all carbon model compounds consisting of OPVs wrapped around OP axis. In order to access structures of dimensions beyond short trimers, a new approach to «Geländer» structures is presented. As alternative molecular design for a B-field sensitive helical chiral structure, a [2.2]paracyclophane subunit was integrated into a thiophene macrocycle[9,10]. The inspection of the suitability of the structures subunit unraveled the pronounced mechanosenstitivity of the pseudo-para [2.2]paracyclophane subunit[11], which was subsequently investigated in details by a small series of model compounds[12]. Triggered by these findings, the concept of mechanosensitive molecular structures was expanded to porphyrin cyclophanes[13-15].

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Titre/Title | Single-molecule junctions

Résumé/Abstract | by the group of Marcel Mayor at the Department of Chemistry of the University of Basel (Switzerland) and the Institute of Nanotechnology (INT) of the Karlsruhe Institute of Technology (KIT, Germany) in collaboration with numerous collaborating teams in experimental Physics and/or Physical Chemistry.

Molecules are the smallest building blocks still providing the structural diversity required to address particular electronic functions. The achieve-ments in synthetic chemistry making tailor-made molecules available raised the interest of electronic engineers to profit from these tiny building blocks to meet the requirements of the ongoing miniaturization in electronic circuits. While the concept of integrating molecules in electronic circuits inspired numerous theorists and remained for long time an academic challenge, recent developments report first massive parallel and CMOS compatible integration strategies.[1]
The presentation will be focused on single molecule transport experiments addressing structure-property correlations in order to investigate the potential and the limitation of molecules as functional electronic building blocks. Entire series of molecules were initially synthesized to proof that indeed single molecule junctions are obtained, like e.g. a series of biphenyl derivatives with fixed inter-phenyl torsion angles.[2] Recently we geared our interest towards molecules responding on external triggers, like *E*-field sensitive structures realized by spin cross-over complexes,[3,4] fixed molecular platforms exposing dipole moment comprising cantilevers,[5] or macrocyclic turnstile structures.[6] An even newer approach are mechano-sensitive structures responding on the alteration of the electrode spacing. While initial experiments were based on compact [2.2]paracyclo-phanes,[7,8] also considerably larger molecular architectures like porphyrin cyclophanes display pronounced mechanosensitivity.[9,10,11].

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Bio | Marcel Mayor was born in Zurich (Switzerland) in 1965 and grew up at the lake of Thun (Switzerland). He studied chemistry at the university of Bern (Switzerland) with diploma in 1991 and dissertation in 1995 on "Vitamin B12 Derivates with peripheral Ion receptors" under the direction of Prof. Dr. Rolf Scheffold and Prof. Dr. Lorenz Walder.

- 1995-1996 Postdoc fellow of the Swiss National Science Foundation with Prof. Dr. Jean-Marie Lehn in the Laboratoire de Chimie Supramoléculaire, Université Louis Pasteur in Strasbourg (France) working on the design and synthesis of reducible cryptatium compounds.
- 1996-1997 Scientist in the Laboratoire de Chimie Supramoléculaire, Université Louis Pasteur in Strasbourg investigating molecular wires.
- 1997-1998 Maître de Confèrence invité at the Collège de France in Paris and at the Laboratoire de Chimie Supramoléculaire, Université Louis Pasteur in Strasbourg.
- Since 1998 research group leader at the Institute for Nanotechnology at the Forschungszentrum Karlsruhe GmbH, Karlsruhe.
- Since 2005 professor for chemistry at the University of Basel.
- Since 2011 adjunct professor of chemistry, Sun Yat-Sen University, Guangzhou (China).

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