

Press release

23th March 2007

## Addressable Nanorotors in a network

**Scientists of the Swiss Nanoscience Institute at the University of Basel and the Paul Scherrer Institute (Switzerland) in collaboration with colleagues from the University of Heidelberg (Germany) have made a major step forward in the development of addressable and functional supramolecular structures. Their work was published this week in the international science journal *Chemical Communications*. The team of Meike Stöhr, Lutz Gade and Thomas Jung incorporated single porphyrin molecules into a self-assembled perylene network. The porphyrin molecules can be thought of as tiny gears turning like rotors in the pores of the network. On this network surface, they behave totally different from porphyrin molecules in a solid state body, in solution or in the gas phase. The researchers are able to slow down the molecule movement by bringing the tip of a scanning tunnelling microscope into very close proximity to an individual molecule.**

Recently, the same scientists reported about the self-assembly and formation of a stable perylene network by a thermal chemical reaction. [Angew. Chem. Int. Ed. 44 (2005)] Now they have used this network to assemble millions of tiny rotors about one nanometer in size in a periodic arrangement on a surface. With a scanning tunnelling microscope each rotor can individually be addressed, activated or slowed down. With raising temperature the rotors turn faster.

The technique described in the paper opens up many more applications as the network architecture can be readily configured. Different molecules can be incorporated into the combs. Like honeycombs that exhibit different functions according to their specific filling, the combs in the nano-network can receive characteristic properties according to the incorporated molecule. Data storage units can be envisaged as well as new optical, chemical or logical switching elements.

The presented work builds on the pioneering work of Professor Jean-Marie Lehn who suggested and showed supramolecular assemblies in the eighties and was honoured with the Nobel Prize in 1987. The research teams from Basel and Heidelberg have now succeeded in producing well-defined, addressable arrays of supramolecular structures and demonstrated their operation. This work provides the key to manufacturing devices by cheap supramolecular self-assembly which may one day compete with much larger and more expensive techniques to fabricate technological devices. While the complexity of the demonstrated network moves towards similar supramolecular assemblies in biology, the nano-networks are stable without water or other solvents. This makes them especially suitable for technical applications.

The presented research was substantially supported by the interdisciplinary collaboration of physicists from the Institute of Physics from the University of Basel and the Paul Scherrer Institute (Villigen, Switzerland) and chemists from the University of Heidelberg. Interdisciplinary co-operations are the key to innovation and are supported in Basel by the Swiss National Science Foundation.

The Swiss Nanoscience Institute (SNI) developed from the National Center of Competence in Research (NCCR) "Nanoscale Science" and constitutes a priority program of the University of Basel. It combines basic science with application-orientated research. In various projects researchers focus on nanoscale structures and aim at providing new impact and ideas to the life sciences, to the sustainable use of resources, and to information and communication technologies. The University of Basel as the leading house coordinates the network of the involved universities, federal research institutes, industrial partners and the Argovia-network, which is financed by the Swiss Canton of Aargau. With the establishment of the SNI the University of Basel continues to secure the internationally acknowledged position as a centre of excellence in nanoscale sciences.

[www.nanoscience.ch](http://www.nanoscience.ch)

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Reachable 8 am to 6 pm central European time zone. If unsuccessful please inquire for call-back via email.

**Original article:**

"Rotation-libration in a hierarchic supramolecular rotor-stator system: Arrhenius activation and retardation by local interaction"

von Markus Wahl, Meike Stöhr, Hannes Spillmann, Thomas A. Jung, Lutz H. Gade in Chem.Comm. DOI 10.1039/b700909g



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