Technische Universiteit Eindhoven University of Technology

Functional supramolecular polymers and materials

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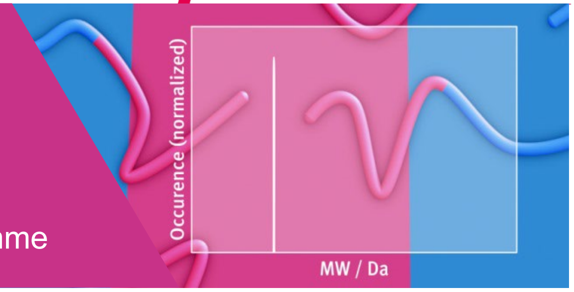
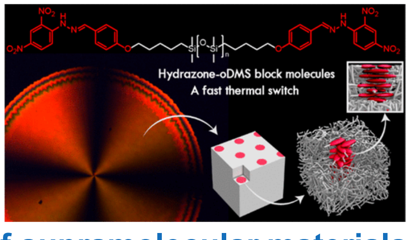


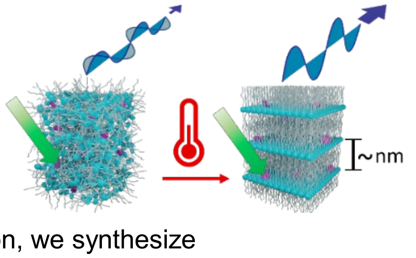
Supramolecular materials for the future

Novel self-assembled polymer materials are needed to create a paradigm shift in opto-electronic materials, nano-lithographic applications, and responsive materials. In contrast to commonly used approaches in this field, we focus on polymeric materials that are perfectly defined at the molecular level and include specific supramolecular interactions to control the architecture at all levels. The advantage of this approach is that molecular structures can be directly related to macromolecular properties. The nature of the envisaged application determines which (combination of) molecular designs will be applied.

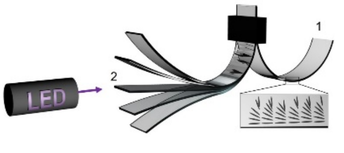


Synthesis of supramolecular materials

We explore an organic approach to make nanomaterials with highly ordered, one- or two-dimensional molecular morphologies with domain sizes <10 nm. These materials are phase-segregated block molecules functionalized with oligodimethylsiloxanes (oDMS) of discrete length. By incorporated hard blocks with electronic properties, we aim at making the next generation of thin transistors. Processing conditions are compatible with the current infrastructure of the microelectronics industry, demonstrating commercial relevance.

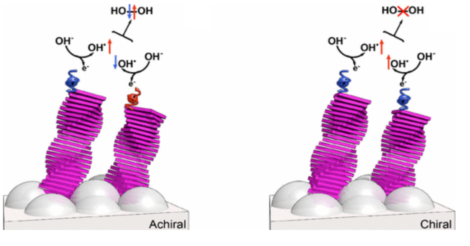


In addition, we synthesize and explore novel materia for macroscopic motion of well-ordered materials for the development of soft robotics .



Chiral Induced Spin Selectivity

The CISS effect relates to how electrons travel through a chiral environment. When electrons go through chiral assemblies, one state of the spin is preferred over the other. We study this phenomenon together with the group of Ron Naaman in Israel to arrive at the most ideal chiral architectures. A real challenge is now to use this CISS effect in spin-controlled chemical reaction. Currently we explore a supramolecular multi-step approach to prepare chiral electrodes and use the CISS effect to increase the efficiency of hydrogen production through water splitting and to synthesize chiral polymers.



Supramolecular electronic materials

We learn how to design assembled structures in which intermolecular interactions maximize charge transport and avoid exciton recombination. This type of materials combine phase-segregated structures with electronic and ionic functions to provide well-organized 1D and 2D channels capable of electrons and ions transport. These soft and stable materials are key for applications in energy conversion, transport and storage.

Bonding and debonding on demand

Recently, we are highly interested in using multiple supramolecular interactions in polymer materials to create systems that are easy to bond and to debond. With this approach, we tackle the issue of plastic recycling and like to address some fundamental questions on dynamic behavior of polymer chains

Master projects and interested?

Passionate students with interest in polymer-material properties and application-oriented research and that like to combine synthesis with measuring physical properties and device fabrication are welcome to strengthen our supramolecular materials team.

/ Macromolecular and Organic Chemistry

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