Technische Universiteit Eindhoven University of Technology

Fundamentals of supramolecular chemistry and beyond

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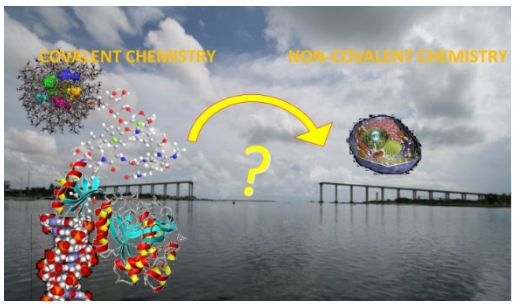
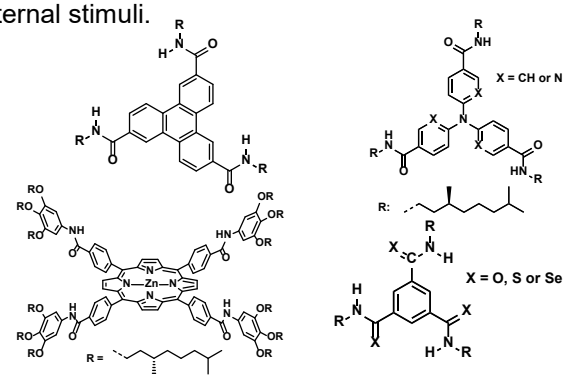
From covalent to non-covalent chemistry

Mastering complexity and multistep non-covalent synthesis are the most challenging research topics in our group. We investigate fundamental issues with respect to self-assembly, but we are also studying new aggregation processes to control non-covalent synthesis of molecular systems. Supramolecular protective groups and competition between supramolecular units are just two of the many challenges that we are currently facing on our way to understanding and mastering the complexity of these processes in order to take non-covalent synthesis to the next level.



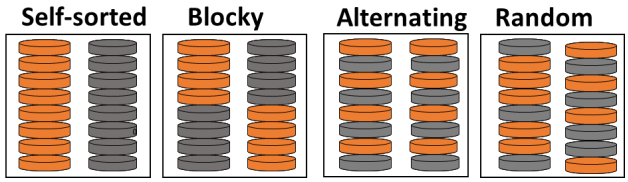
Supramolecular polymerizations

By studying the one-component polymerisation of disc-like molecules experimentally as well as theoretically, we have quantified the thermodynamic characteristics of a wide range of polymers. An important goal is the ability to *predict* how the molecular structure translates to the nature of the self-assembly process and stability of the aggregates formed, leading to new motifs and supramolecular polymers that can be used in the other two topics in the group. Moreover, we like to arrive on a full understanding of the role of solvent and other external stimuli.



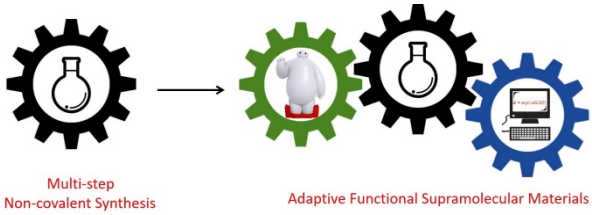
Supramolecular copolymerizations

A combination of experimental techniques and mathematical models permits to elucidate the thermodynamics and kinetics of polymerisation processes of two (or more) monomers. This allows to tune both the *sequence* and *length* of the copolymers. The properties of the SM polymers can also be altered by using two monomers. Our ambition is to control the microstructure in solution and hereby achieve outstanding properties in the corresponding bulk materials.



Multi-step non-covalent synthesis

Like in covalent synthesis, the outcome of a non-covalent synthesis reaction is determined by the order of events. We currently design multiple component systems, that have multiple different types of interactions to arrive at adaptive functional supramolecular materials. An important novel concept in the group is the combination of covalent and non-covalent synthesis, by which stability of the supramolecular structures can be tuned, leading to follow-up synthetic steps. This very fundamental investigations are essential aspects of understanding some of the essential steps in the origin of life.



Master projects – interested?

We are looking for passionate students that like to combine modelling with experimental approaches and get excited by fundamentally understanding how a collective set of molecules behave. Also synthetic chemists intrigued by the plethora of possibilities of new molecular systems are highly welcome. Many projects are available on this subject.

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