Research project objectives

The aim of this project is the design, generation and full spectral and structural analysis of a new series of multi-component, three-dimensional organic cages with based on dynamic imine bonds. The obtained new generation of cage-like systems together with the selected structures previously known in the literature will form a Dynamic Combinatorial Library (DCL) of components for which the dynamics of self-sorting process, component selection and transformations of the structures under the influence of chemical or physical stimuli will be studied. The project assumes an innovative approach to imine cage-like systems focusing on a precise analysis of their dynamics. This can directly translate into development of a new generation of dynamic materials, which can be applied in modern branches of nanochemistry and nanoindustry.

Basic research

The project was initiated during the scientific internship of the applicant in the research group of Nobel Prize laureate – prof. Jean-Marie Lehn at the Institut de Science et d'Ingénierie Supramoléculaires in Strasbourg. Research will be continued as a collaborative work between Lehn and Stefankiewicz research groups. Supramolecular, three-dimensional cage structures represent a fascinating and extremely important class of compounds. Their 3D structure creates wide-range of opportunities especially in host-guest chemistry. This translates into diverse use of cage-like structures in areas such as nanotechnology, supramolecular engineering, chemistry of materials, biomedical chemistry or biotechnology. In the proposed project, a new generation of three-dimensional organic cages incorporating dynamic imine bonds in their structure will be designed and synthesized. Cage-like system obtained during the research will create a library of compounds for which dynamics of self-sorting process will be studied and described (Figure 1). The presence of dynamic imine bonds in the cage-like architectures will allow for structural transformation and change in the composition of dynamic library of components. Understanding the interactions that drive these processes will enable more precise design of dynamic component libraries, from which it will be possible to isolate the cage-type complexes in selective manner i.e. by acting on the library with an effector – guest molecule.

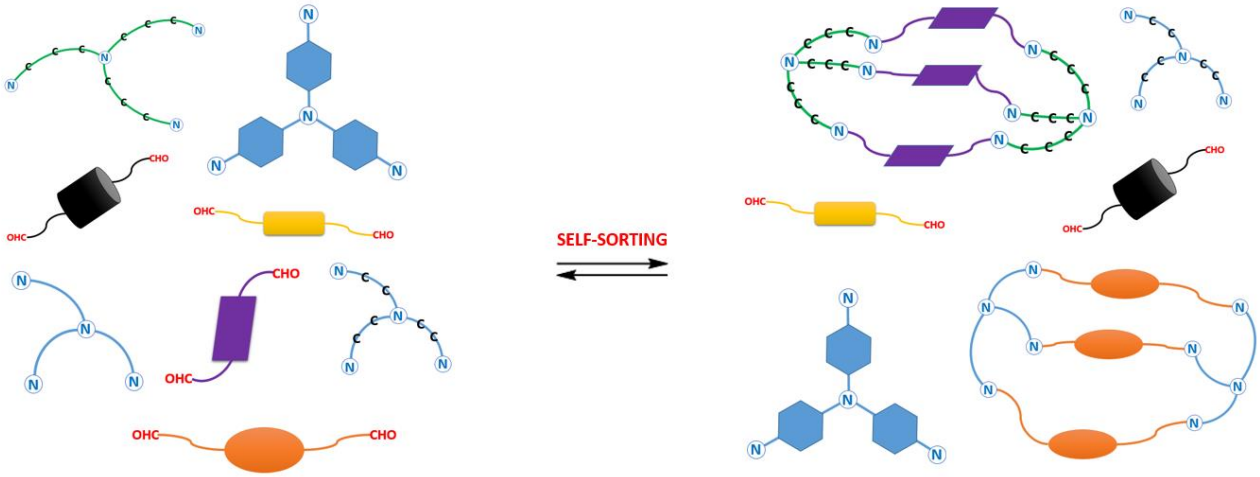

Figure 1. Schematic representation of self-sorting of dynamic systems from mixed library of bisaldehyde and triamine components.

Research project impact

The knowledge gained in the proposed research will have a significant impact on understanding the dynamics of three-dimensional, purely organic cage-like architectures. It will allow to precisely design and control sophisticated component libraries. This can directly translate into development of a new generation of dynamic materials, which can be applied in modern branches of nanochemistry and adaptive systems. It is worth noting that the proposed research project takes into account current trends in supra-/molecular nanomaterials. It is also important that the presented research is interdisciplinary as it combines many fields of chemistry.