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Self-assembly by selection of copper-zinc helicates

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The aesthetic peculiarities of helical geometry fascinated mankind since time immemorial, becoming one of the principal motifs adopted by human art and architecture. More recently, helical motive has also intrigued attention of modern chemists, who have designed countless molecules specifically to combine its chemical and spatial properties in “artificial” chemical systems.

Whereas the assembly of biological supramolecular structures makes mainly use of organic non-covalent interactions (hydrogen donor-acceptor interactions, Van der Waals forces), metal ion binding provides a variety of coordination geometries which offer a rich set of connection patterns. A very broad range of binding strengths and formation kinetics can be explored depending on the nature of the metal cation and the ligand binding sites. Moreover, different metal cations offer the possibility to alter the electronic and binding properties through the external physical stimuli such as light or electricity.

The correct application of supramolecular chemistry and self-assembly combined with the proper design of molecular frameworks allow to achieve not only well-defined output architectures but also different grades of complex behaviour.

The systems investigated offer an additional level of complexity by combining self-sorting on two levels: 1) the build-up of the ligand strand constituents from their components through dynamic covalent chemistry; 2) the assembly of the helicates from the ligands and the metal cations through dynamic metallo-supramolecular chemistry. The information encoded in the ligands were read differently (and accurately at the same time) by metal cations that varied in the coordination algorithms. It enabled the selective formation of a specific type of helicates from a wide library of complexes formed by the possible combination of subcomponents.

Biography

Dr. Antonio Santoro obtained his PhD in Chemical Science from University of Messina in 2016 discussing a thesis on supramolecular photochemistry. In the same year he joined in the group of Prof. Jean-Marie Lehn (Nobel Laureate in Chemistry in 1987) at Institut de Science et d'Ingénierie Supramoléculaires (Strasbourg, FR) as post-doc researcher, working on synthesis and characterization of responsive grid and helicate systems, until the end of 2018. Then, he moved back to the Department of Chemical, Biological, Pharmaceutical and Environmental Science at the University of Messina, where he took a junior researcher position in July 2019, he was also a visiting researcher at the Tokyo Institute of Technology during 2020. His area of interest concerns supramolecular photochemistry, metallo supramolecular chemistry and covalent dynamic chemistry.