

Chimie supramoléculaire



Niveau
d'étude
BAC +5 /
master



ECTS
3 crédits



Composante
Faculté des
sciences

En bref

- Langue(s) d'enseignement: Français
- Ouvert aux étudiants en échange: Oui

Présentation

Description

Supramolecular Chemistry: basics (9h)

From molecular to supramolecular chemistry.

Supramolecular interactions.

Characterization of supramolecular structures.

Host molecules for the recognition of cations, anions and neutral molecules.

Chemosensors.

Molecular flasks.

Supramolecular catalysis.

Supramolecular polymerization (4h)

Physical and chemical gels.

Application fields (conducting materials, mesophases, self-healing systems,...).

Description of supramolecular polymerization processes (isodesmic, cooperative, chain-growth).

Chirality and supramolecular polymers ("sergeant and soldiers" and "majority rules" experiments).

H and J aggregates.

Supramolecular Chemistry based on metal (12h)

Basics and tools.

Self-assembling: helicates.

Self-assembling: grids, ladders and racks.

Self-assembling: molecular polygons and polyhedra.

Catenanes, rotaxanes and molecular knots.

Molecular machines.

Supramolecular polymers.

Objectifs

This teaching unit provides the conceptual bases of supramolecular chemistry, a modern axis of chemistry centered on non-covalent interactions that is playing a key role in materials science and in particular in designing organized structures for complex functions, including at the macroscopic scale (molecular receptors, sensors, molecular machines, ...). The aim is to show students how this transverse new field of chemistry, often inspired by biological processes, can allow through a well-balanced use of various tools of chemistry (organic synthesis, coordination chemistry, spectroscopies, physical chemistry, analytical chemistry), to control the structuring and the properties of different classes of materials, on scales ranging from nano- to micrometric sizes. In particular, mastering these tools allow to design sophisticated supramolecular objects whose complexity could not be reached through traditional covalent synthesis.

The first part of this teaching unit is related to the foundations on which is built this transverse field of chemistry (nature and characterization of non-covalent interactions, self-assembly and molecular recognition processes towards discrete structures, designing molecular receptors).

The module continues with an extension of these concepts to the case of supramolecular polymerization (gels), and then to the rational use of coordination bonds for the construction of various supramolecular architectures and beyond, till the design of dynamic structures (molecular machines).

The complexity of the resulting systems is illustrated with the help of various recent examples from the literature. Also, practical work sessions (10h) allow to tackle several of these aspects. Finally, this course aims at stimulating the creativity of students in order to integrate the corresponding concepts into the different application areas which are considered in the other modules of the Master LUMOMAT.

Heures d'enseignement

CM	Cours magistral	25h
TP	Travaux pratique	10h

Compétences visées

- # Know and identify non-covalent interactions.
- # Know main families of natural and synthetic receptors (including their synthetic access).
- # Apply various analytical methods for addressing the thermodynamics of host-guest complexes.
- # Know new concepts associated to the reactivity in confined spaces.
- # Understand the supramolecular polymerization mechanisms (isodesmic, cooperative, ...).
- # Know the metal-directed strategies towards discrete and polymeric supramolecular structures based on metals.
- # Know interlocked, stimuli-responsive and dynamic systems.

Infos pratiques

Lieu(x)

➤ Angers

Campus

➤ Campus Belle-beille