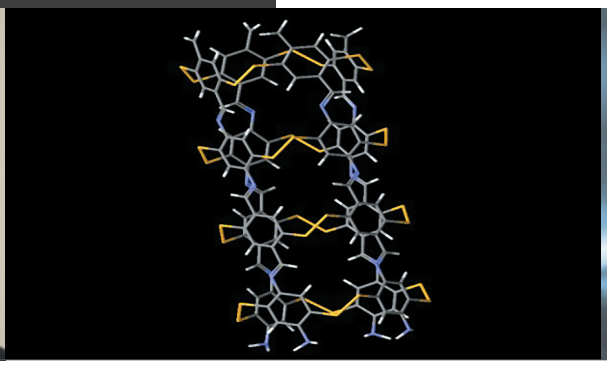
| GROUP

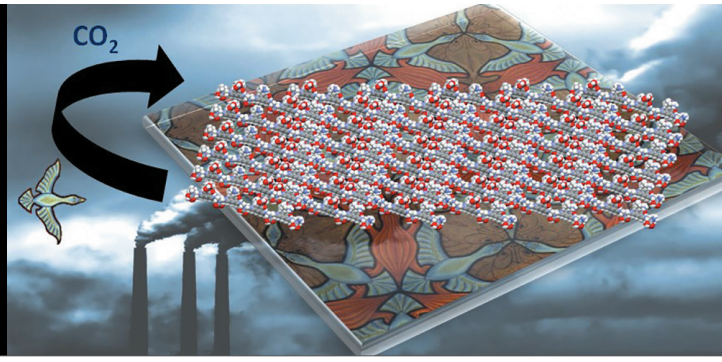
APPLIED SUPRAMOLECULAR CHEMISTRY (CSAp)

CBMS - UMR 5246, UNIVERSITÉ CLAUDE BERNARD LYON 1 - CNRS - INSA LYON - CPE LYON

JULIEN LECLAIRE

Professor





The CSAp group focuses on the development of new supramolecular systems, from nano-objects to nano-materials. Our research projects are oriented towards the construction of functional molecular architectures for optimized molecular recognition. This recognition can involve one or several molecular partners and thereby yield receptors, selectors, sensors, carriers catalysts or switches. It can also involve molecular assemblies and provide novel materials with original properties (depollution, transportation, information storage, self-healing, etc...).
Our group is a constituent of ICBMS, a synthetic chemistry and biochemistry research institute of the University Lyon 1, CNRS, INSA Lyon and CPE-Lyon (www.icbms.fr), located on the La Doua Campus of the University of Lyon, in Villeurbanne.

TOPICS

Nano-objects: Static (Calixarene & cyclodextrin) and Dynamic (Dynamic Combinatorial Libraries) - Molecular Recognition – Protein binding – Supramolecular Catalysis – Stereoselectivity.
Nano-materials: Self-assembled & organized material – Catalytic surfaces.

TAILORED MOLECULAR RECOGNITION AND NANO-OBJECTS

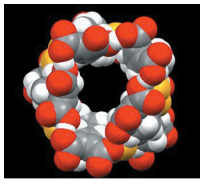
Through our synthetic expertise, selective functionalization of calixarenes and cyclodextrins can be achieved for the optimized molecular recognition of guests such as biomolecules or metals. In the former case, targeting groups can additionally be introduced leading to dual objects with vectorizing properties. In the latter case, the macrocyclic cavity can act as a nano-reactor providing original catalytic properties.
As an alternative methodology, dynamic combinatorial chemistry is used to generate new families of self-assembled nano-objects for tailored molecular recognition. This strategy provides a straightforward access to optimized polyfunctional macrocycles for the selective recognition of biologically active or environmentally relevant structures, leading to sensors and selectors for industrial applications. Static architectures such as calixarenes can be used as molecular partners to inform dynamic combinatorial libraries, yielding self-assembled capsules, polymers and superstructures.

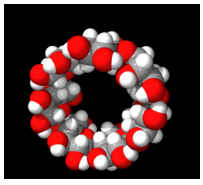
SUPRAMOLECULAR ASSEMBLIES AND NANO-MATERIALS

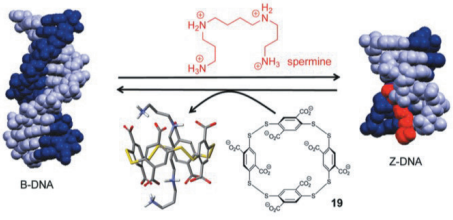
Strategies yielding functional 2D and 3D nanomaterials based on highly organized nanoarchitectures are explored. Metal complexes of functionalized calixarenes displaying the ability to commute between two redox states are being immobilized on surfaces to provide new materials possessing configurable properties such as molecular information storage. Multi-component dynamic combinatorial strategies are also used to selectively capture valuable molecules from waste into self-assembled nanomaterial. Such technologies allow to recycle and purify chemical components and promote them as key ingredients for smart material displaying original physical (gas storage) and chemical properties (catalysis).

| Figures

Top: Scheme of molecular switches used for information storage.
Bottom Left: Self-assembled nanotube made of complementary self-assembled macrocycles.
Right: Multicomponent self-assembled material based on CO_2.





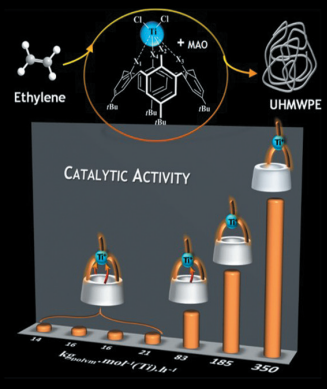


| EQUIPMENT

› Recently renewed laboratories
› Automated flash chromatography
› HPLC-(MS)
› Microwave reactor
› FT-IR
› Lyophilisator

| EXPERTISES

› Dynamic Combinatorial Chemistry
› Calixarene derivative synthesis
› Cyclodextrin selective modification
› Organic nanoparticle formation
› Optimized molecular recognition
› Large scale calixarene synthesis



COLLABORATIONS

The CSAp group is a member of the i-MuST LABEX (Institute for Multiscale Sciences and Technologies) and develops strong partnerships with many academic groups, industrial actors and agencies: University of Cambridge (UK), Fudan University (China), UCB Pharma, CEA Grenoble, DCM-CIRE Grenoble, Institut Francais du Pétrole, ICCF Clermont-Ferrand, ISPB Lyon, LAGEP Lyon, CRMN Lyon, University of Geneva, Institut Madirel Marseille, Faculty of Pharmacy of Debrecen (Hungary).

PUBLICATIONS

The group publishes in international journals of chemistry and related sciences. Full list is available on the website www.icbms.fr.

KEYWORDS

Supramolecular chemistry – Dynamic Combinatorial Chemistry - Calixarene – Cyclodextrins - Self-assembling – Molecular recognition - Nanomaterial – Molecular switches – Green Processes - Catalysis.

STAFF

Julien Leclaire, *Professor Group Leader*
Isabelle Bonnamour, *Associate Professor*
Ulrich Darbost, *Associate Professor*
Caroline Félix, *Associate Professor*
Florent Perret, *Associate Professor*

1-2 Postdoctoral researchers
2-3 PhD Students
2-3 Graduate Students

| Figures

Left top: Compared structures of Self-assembled carcerand and cyclodextrin.

Left bottom : Selective complexation of DNA ligand by a self-assembled architecture

Right: Calixarene derivatives showing high performance on polyethylene synthesis catalysis

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