Ph.D position in organic synthesis and photocatalysis

Title: Encapsulated bimetallic complexes based on Earth-abundant metals for (photo)catalysis.

Research group: Team *Organic Biological & Supramolecular Glycochemistry* (GOBS, Pariian Institute of Molecular Chemistry), Sorbonne Université, campus P. et M. Curie, Paris 5ème, France.

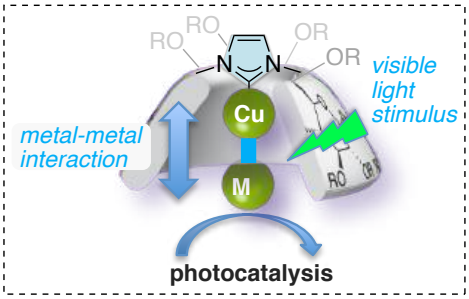
Supervisors & contacts: Pr. Matthieu Sollogoub (matthieu.sollogoub@sorbonne-universite.fr), Dr. Sylvain Roland (sylvain.roland@sorbonne-universite.fr).

Duration : 36 months, starting 1srt october 2025

Funding and context: ANR funding, collaborative ANR-NSF project (ANR-24-CE07-6018 CuBicBeam) between the GOBS team (France) and Pr N. Mankad's group (University of Illinois Chicago, USA).

Project: Metal complexes have emerged as effective tools to promote light-induced chemical transformations. Homogeneous photocatalysis has been dominated by rare metals such as Ru and Ir which, with the appropriate ligands, strongly absorb visible light, an indispensable property for harnessing solar energy as a renewable energy source to develop sustainable processes in chemistry. Recently, however, the development of photoactivatable complexes with Earth-abundant metals has attracted increasing attention and copper has emerged as a promising alternative to precious metals. Copper complexes have certain structural advantages but globally exhibit low photoactivity in the visible range. The innovative nature of the project consists of exploiting a supramolecular cyclodextrin (CD) platform comprising a cavity to introduce Cu(I) by encapsulation and promote the construction of bimetallic complexes by associating Cu(I) with a second abundant metal and appropriate ligands to increase the photoactivity under visible light exposure. Examples of photoactivatable bimetallic complexes are very rare, and those based on Earth-abundant metals with M...M metallophillic interactions have not been explored. The GOBS group (Sorbonne University, France) has already shown that the encapsulation of Cu(I) in CDs induces particular cavity-dependent catalytic properties,[1] and has launched a program for the design of Cu-based photoactivatable complexes. The Mankad group (University of Illinois Chicago, USA) is very experienced in bimetallic complexes with Cu and has developed advanced techniques (resonant X-ray diffraction and charge density measurements) to analyze their structure. The two groups will work in synergy to design,[2] synthesize and analyze the structures/properties of bimetallic complexes with the aim of improving photocatalytic systems using abundant metals and visible light. The thesis work will focus on these objectives.

Visible light photo-activatable bimetallic complexes based on Earth-abundant metals



Profile and skills of the candidate: A Master in organic chemistry is required with a strong theorical background in organic chemistry. Knowledge of metal catalysis or photocatalysis is welcome. Candidates must master classical synthetic chemistry techniques and spectroscopic analyses. Candidates must be able to work independently in the laboratory. Previous experience in an organic synthesis and/or catalysis research laboratory would be welcome. Very good oral and written communication skills in English (French is not compulsory) are required.

Application: The application must include a detailled CV and a motivation letter. At least two reference contacts must be given. Recommendation letters are also welcome. Master's grades will be requested.

[1] For CD-based copper complexes and catalysis, *see*: M. Sollogoub et coll., *Angew. Chem. Int. Ed.* **2013**, *52*, 7213; S. Roland, M. Sollogoub et coll, *Angew. Chem. Int. Ed.* **2017**, *56*, 10821; L. Fensterbank, M. Sollogoub et coll., *Chem* **2017**, *3*, 174; O. Riant, M. Sollogoub et coll., *Angew. Chem. Int. Ed.* **2020**, *59*, 7591; Z. Wen, E. Maisonhaute, Y. Zhang, S. Roland, M. Sollogoub, *Chem. Commun.* **2022**, *58*, 4516.

[2] For encapsulated bimetallic complexes, *see*: N. P. Mankad, S. Roland, M. Sollogoub, J. E. Stevens, *Organometallics* **2024**, *43*, 1165.