LABEX ARCANE AAP 15 - PhD project TOTHEM

Laboratory of Chemistry and Biology of metals, teams BioCE & BEE
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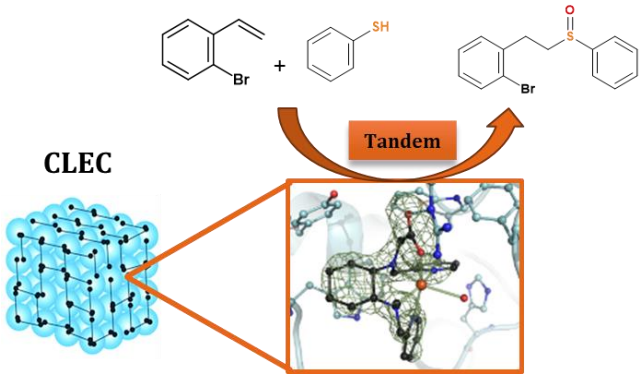
Thiol-ene/Oxidation Tandem reaction by HEterogeneous artificial Metalloenzymes - TOTHEM

Keywords:
Bioinspired chemistry, artificial enzymes, heterogeneous catalysis, thiol-ene reaction, sulfoxidation, cross-linked enzyme crystals.

Aims:
The aim of this project is to develop a new reactivity by combining catalytic systems already known to work efficiently but separately. The PhD student will have to conduct its own project from the ligand synthesis to the set-up of the catalytic tandem reaction.

Learnings:
Learning how to deal with an interface project between two groups, combining chemistry and biochemistry. Practice organic and inorganic synthesis with the aim of using the synthesized object directly as a catalyst or as an active center of an artificial enzyme. Be able to set up the right experiment and analyze the results. Be sensitive to biochemical practices.

Summary:
This interdisciplinary project deals with the conception of innovative solutions for a sustainable chemistry in the field of synthetic biology. Accordingly, the project concerns basic science to develop new catalytic solutions for green chemistry, involving a bio-inspired design of heterogeneous artificial biocatalysts. The teams have already validated the relevance of crystalline artificial metalloenzymes to design new biotechnological solutions and here we propose to go further by creating cascade reactions *in cristallo*.[1] The different catalysts needed for each reaction will be either crystalline biohybrids (CLEC technology) or soluble complexes. The first tandem reaction tested will be a hydrothiolation or thiol-ene reaction – sulfoxidation sequence with a mix of iron and vanadium complexes. The first challenge will be to modify a vanadium ligand in order to anchor it into the protein without changing its reactivity.
The PhD student will have to synthesize ligands and inorganic complexes and probe their capacity to catalyze oxidation reactions in the presence or absence of the protein in solution and in heterogeneous conditions. His/Her involvement in protein crystallography and biochemistry will be recommended.



Technical skills:
Organic synthesis – inorganic synthesis – homogeneous and heterogeneous catalysis – protein crystallography, biochemistry.
Spectroscopic skills: NMR, EPR, UV-visible, GC(MS) and HPLC(MS), Mass spectrometry.

Expertise needed:
Synthesis (organic and inorganic), a real motivation for learning new methodologies and an interest for biochemistry and chemistry/biology interface.

(1) a) Lopez, S.; Rondot, L.; Leprêtre, C.; Marchi-Delapierre, C.; Ménage, S.; Cavazza, C. *J. Am. Chem. Soc.* 2017, *139*, 17994; b) Lopez, S.; Marchi-Delapierre, C.; Cavazza, C.; Ménage, S. *Chem. Eur. J.* 2020, *26*, 16633.