PhD Proposal 2017

School:	
Laboratory: iSM2	**Web site:** http://ism2.univ-amu.fr/pages-bleues/index2.htm
Team: Biosciences	**Head of the team:** Thierry Tron
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Collaboration with other partner during this PhD: **In France:** Rénal Backov (CRPP, Bordeaux); Eric Déniau (UCCS, Lille).	**In China:**

Title: Supported artificial metalloenzymes for aerobic oxidation of organic compounds
Scientific field: solid chemistry, interface biology- chemistry,catalysis; renewable energy
Key words: Silica macro/mesoporous foam, homogeneous, heterogeneous, (bio)catalysis, aerobic oxidation, alcohol, copper, palladium, laccase

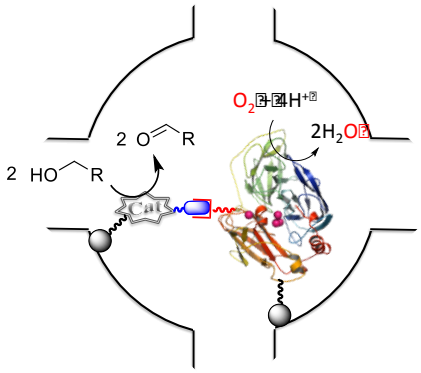
Details for the subject:

Background, Context:

The development of new processes for sustainable chemistry is at the heart of the great challenges of tomorrow. In heterogeneous catalysis or supported catalysis, major breakthroughs are expected in terms of functionalization and surface modification as well as in the development of nano-catalysts. Indeed, there is a growing interest on achieving a comprehensive view of processes that control all mechanistic aspects related to stability, efficiency and selectivity of reactions catalyzed by these systems often much less controlled than in homogeneous catalysis. The ultimate aim is to understand fundamental synthesis and processing concepts in order to tailor materials fully controlling all involved mechanistic aspects.

Research subject, work plan:

The research subject we are proposing aims at developing new supported hybrid catalyst for cooperative oxidative transformation of alcohols. The vectorization of an oxidant module represented by a transition-metal-based-catalyst will be performed at the surface and close vicinity to the active copper center of a robust laccase to perform safe dioxygen reduction into water in a cooperative mode. This hybrid catalyst will then be confined in tailor-made silica-based nanomaterials to provide new properties to the hybrid catalyst dealing with stability, selectivity, efficiency and recyclability. Immobilizing both the catalyst and the bio-catalyst into the same cavity of a macroporous heterogeneous support we aim at creating a local environment where every species can work in close vicinity which will promote cooperativity. The ambitious goal of this project is to develop a new generation of catalyst/enzyme hybrid supported microreactors for continuous flow catalysis. To this end, the project will focus on the exploitation and integration of different scientific approaches to build up and study the different components of the system: production of recyclable hybrid catalyst; immobilization of the hybrid catalyst; catalytic efficiency of the supported catalyst on model reaction; optimization of a new material for continuous flow catalysis. To this end, several methodologies with emphasis biochemistry, organic and inorganic synthesis, physico-chemistry and catalysis will be evaluated.



Schematic representation of a porous silica foam immobilized hybrid catatyst for alcohol oxidation.

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