Accord CSC - UdL	Campagne 2017/2018 – Sujet de Thèse
Ecole Doctorale	

RESEARCH SUBJECT TITLE/TITRE DU SUJET DE RECHERCHE:

DYNAMIC REDOX-RESPONSIVE (SUPRA)MOLECULAR SYSTEMS FOR CATALYTIC FUNCTION

Laboratory/Laboratoire: Laboratoire de Chimie, École Normale Supérieure de Lyon.
Website: http://www.ens-lyon.fr/CHIMIE

Research team/Équipe de recherche: Supramolecular Chemistry & Chemical Biology.
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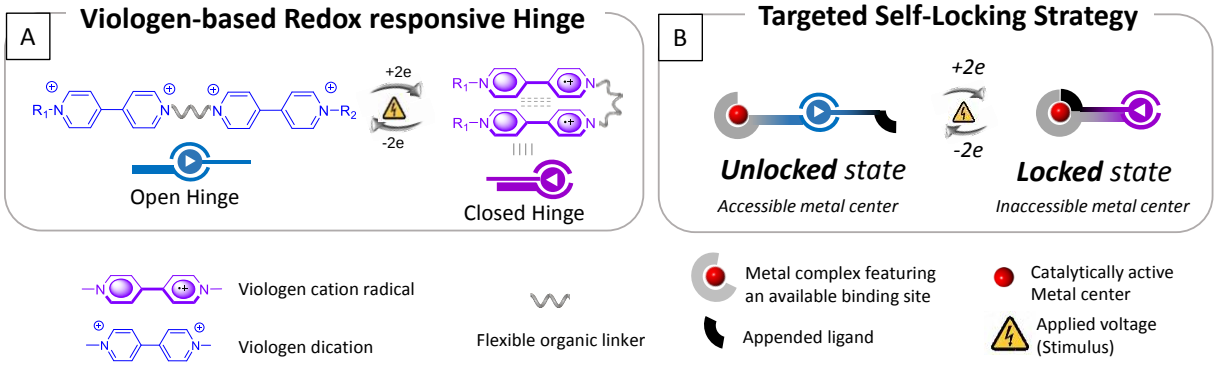
Doctoral School/École doctorale: École Doctorale de Chimie.

Lab Language/Langue de travail: English, français.

Abstract/Présentation du sujet:
Controlling molecular motions has emerged in recent years as a promising approach for the development of molecules featuring tuneable catalytic activities, the underlying idea being that changing the structure of a catalytically active system could potentially induce drastic modifications of its activity.[1] In such context, the proposed project aims at developing dynamic responsive molecular systems for which **large amplitude motions actuated by electron transfer can be used to control the catalytic activities of key metallic centers** embedded in the structure.
The main focus of this PhD project will be on the development of redox-controllable mechano-responsive catalysts involving the π-dimerization of viologen cation radicals as driving force of structural reorganizations (Fig A). The concepts proposed in this project, involving molecular motion as key driver of catalytic functions, built on the expertise accumulated over the years at ENS-Lyon in homogeneous catalysis[2] and on redox–triggered dimerization processes.[3] One concept which will be developed is based on the self-locking principle sketched on Fig. B. **It aims at controlling the coordination number of a catalytically active metal center upon electric stimulation of a viologen-based mechanical hinge**. Particular attention will be devoted to challenging catalytic transformations involving carbon dioxide as a reactant[4] (e.g., CO_2 reduction or chemical fixation with oxiranes[5]).



This multidisciplinary project is at the interface between catalysis, organic chemistry, coordination and supramolecular chemistry. The applicant will ideally have a multidisciplinary background with a significant expertise in organic chemistry.

Keywords/mots-clés:
Switchable Catalysts, Molecular Metamorphism, Electric Stimulation, π-Dimerization, CO_2 activation.

[1] M. Vlatković, B. S. L. Collins, B. L. Feringa, *Chem. Eur. J.* **2016**, *22*, 17080-17111. http://dx.doi.org/10.1002/chem.201602453
[2] F. Chevallier, B. Breit, *Angew. Chem. Int. Ed.* **2006**, *45*, 1599-1602. http://dx.doi.org/10.1002/anie.200503826
[3] a) A. Iordache, M. Oltean, A. Milet, F. Thomas, B. Baptiste, E. Saint-Aman, C. Bucher, *J. Am. Chem. Soc.* **2012**, *134*, 2653-2671. http://dx.doi.org/10.1021/ja209766e b) A. Iordache, M. Retegan, F. Thomas, G. Royal, E. Saint-Aman, C. Bucher, *Chem. Eur. J.* **2012**, *18*, 7648-7653. http://dx.doi.org/10.1002/chem.201200842 c) C. Kahlfuss, S. Denis-Quanquin, N. Calin, E. Dumont, M. Garavelli, G. Royal, S. Cobo, E. Saint-Aman, C. Bucher, *J. Am. Chem. Soc.* **2016**, *138*, 15234-15242. http://dx.doi.org/10.1021/jacs.6b09311
[4] K. S. Lackner, *Science* **2003**, *300*, 1677-1678. http://dx.doi.org/10.1126/science.1079033
[5] T. Sakakura, K. Kohno, *Chem. Commun.* **2009**, 1312-1330. http://dx.doi.org/10.1039/B819997C