

## POSTDOCTORAL POSITION

### MAIN GROUP ELEMENTS CHEMISTRY, ORGANOMETALLIC CHEMISTRY AND PHYSICAL-ORGANIC CHEMISTRY

#### Nucleophilicity and electrophilicity, key parameters to understand and control the transformation of CO<sub>2</sub> and SO<sub>2</sub>

The valorization of CO<sub>2</sub> and its sulfur analog, SO<sub>2</sub>, are key challenges to support a sustainable chemical industry. Today, these small molecules are regarded as wastes and their transformation requires the design of efficient catalysts, able to overcome their thermodynamic and kinetic stability. This challenge translates into a very limited number of processes capitalizing on CO<sub>2</sub> and SO<sub>2</sub> as carbon and sulfur feedstocks.

To foster the discovery and design of novel reactions utilizing CO<sub>2</sub> and SO<sub>2</sub>, a better understanding and description of their intrinsic reactivity are necessary. Though electrophilicity of a large panel of charged and neutral electrophiles have been quantified, this parameter has never been measured for CO<sub>2</sub> and SO<sub>2</sub>. The postdoctoral fellow will be in charge of synthetic and kinetic studies aiming at measuring the electrophilicity parameters ( $E$ ) for CO<sub>2</sub> and SO<sub>2</sub>, in their free form but also as adducts with organic catalysts such as Frustrated Lewis Pairs (FLPs). Because they are important intermediates in the reductive functionalization of CO<sub>2</sub>, the electrophilicity parameters of the reduced forms of CO<sub>2</sub>, namely formic acid, formaldehyde and methanol, will also be measured. In a second stage, the nucleophilicity parameters ( $N$ ,  $s_N$ ) of reductants used in CO<sub>2</sub> reduction (e.g. hydrosilanes and hydroboranes) will be determined and the effect of organic catalysts on their reactivity assessed. The project is hence at the crossroads of homogenous catalysis, physical-organic chemistry and molecular synthetic chemistry. The postdoctoral fellow will be hosted in the [Cantat research group](#) at CEA Saclay and work in close collaboration with the [Laboratory of Molecular and Thiorganic Chemistry](#) (LCMT) at ENSICAen. The consortium is a multidisciplinary team gathering all activities from molecular chemistry and catalysis to physical-organic chemistry.

#### Literature references from the host groups:

- [1] E. Blondiaux, J. Pouessel, T. Cantat, *Angew. Chem. Int. Ed.* **2014**, *53*, 12186-12190.
- [2] C. D. Gomes, O. Jacquet, C. Villiers, P. Thuery, M. Ephritikhine, T. Cantat, *Angew. Chem. Int. Ed.* **2012**, *51*, 187-190.
- [3] O. Jacquet, X. Frogneux, C. D. Gomes, T. Cantat, *Chem. Sci.* **2013**, *4*, 2127-2131.
- [4] O. Jacquet, C. Das Neves Gomes, M. Ephritikhine, T. Cantat, *J. Am. Chem. Soc.* **2012**, *134*, 2934-2937.
- [5] N. Von Wolff, J. Char, X. Frogneux, T. Cantat, *Angew. Chem. Int. Ed.* **2017**, *56*, 5616-5619.
- [6] J. Dupré, A.-C. Gaumont, S. Lakhdar, *Org. Lett.* **2017**, *19*, 694.
- [7] S. Lakhdar, *Quantitative Treatments of Nucleophilicity and Carbon Lewis Basicity*. In *Lewis Base Catalysis in Organic Synthesis*; Vedejs, E.; Denmark, S., Eds.; Wiley-VCH, **2016**, Chapter 4.

#### Position

1 year, available from February 2019

Gross salary: ca. 2850 €/month

Location: CEA Saclay, University of Paris-Saclay (Saclay) and ENSICAen (Caen)

The position is co-funded by the [CHARMMAT](#) and [SYNORG](#) Laboratories of Excellence in France

The applicant must hold a PhD in molecular chemistry with an experience in organic chemistry and/or catalysis.

#### To apply, please contact:

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