

Valorization of methanol as C1 source in chemistry *via* homogeneous organometallic catalysis

PhD proposal 2018-2021

Under the supervision of **Jean-Baptiste Sortais** (Full Professor, Université Paul Sabatier, Toulouse)

Location : **Laboratoire de Chimie de Coordination du CNRS** (LCC), Toulouse, France

Context: In the context of green and sustainable development, the utilization of non-toxic, inexpensive, renewable and readily available reagents is highly desirable. As such, the replacement of hazardous and waste-generating reactants embraces several of the 12 principles of green chemistry, especially when coupled with catalysis. Methanol, the simplest alcohol, can be used as a green and renewable C1 source for methylation reactions using the hydrogen borrowing methodology. Actually, "Methanol Economy" identifies and promotes methanol as a substitute for petroleum oil in the field of energy and chemistry. Methanol is a biodegradable liquid, easy to handle and a safe chemical to produce, compared to, for example, formaldehyde, acetic acid, or ethylene. In addition, due to the plurality of its supply, including renewable sources, methanol is a sustainable building block.

Objectives: The final goal of this project is to incorporate methanol in organic molecules as $-CH_3$ fragment (α -C-methylation of ketones, esters, nitriles or *N*-methylation of amines), as $-CHO$ fragment (*N*-formylation of amines) or $-OCH_3$ (oxidative esterification of alcohols with methanol), via hydrogen borrowing reactions leading solely to water and di-hydrogen as by product. To reach this objective, one important part of the research will be devoted to the design and synthesis of base metals (iron, nickel, manganese) catalysts, and of the corresponding ligands, that will allowed activating methanol via dehydrogenation reactions. Mechanistic studies to understand completely catalytic processes will also be crucial to improve catalytic performance and tune finely the selectivity of the methylation.

This project relies strongly on the recognized background of the team in ligands synthesis, coordination chemistry and catalysis with earth abundant metals (Team A of the LCC, <https://www.lcc-toulouse.fr/article101.html>).

Starting date: October 2018, **Duration:** 36 months, **Salary:** c.a. 1400 euros net

Expected profile: We are looking for a highly motivated graduated student willing to work at the frontier of organic chemistry, coordination chemistry and homogeneous catalysis. Previous knowledge in one this field would be appreciated. As the team is mostly international, a good level in English is required for daily and scientific communications.

Application: Please send a CV and a motivation letter with the name of two referees to jean-baptiste.sortais@lcc-toulouse.fr