

ITI HiFunMat Master Internship Proposal

M 1

M 2

Title

Internship supervisor

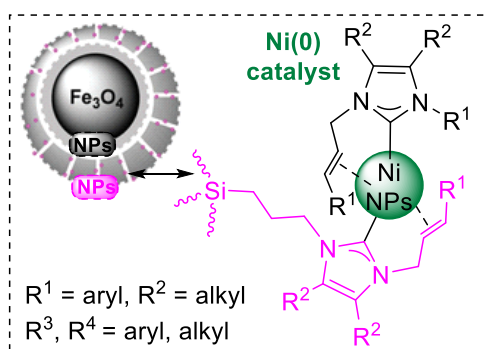
Name, first name	MICHON, Christophe
E-mail, Telephone	cmichon@unistra.fr, 03.68.85.28.08
Laboratory	LIMA UMR7042 CNRS-Unistra
Collaboration with a HiFunMat member (<i>please indicate their name</i>)	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes : Dr Benoit LOUIS (ICPEES UMR7515 CNRS Unistra)

Student profile looked for

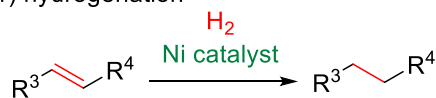
Master program (<i>more than one box can be ticked</i>)	<input checked="" type="checkbox"/> Material science and engineering <input checked="" type="checkbox"/> Chemistry <input type="checkbox"/> Physics
Other indications if necessary	

Internship description

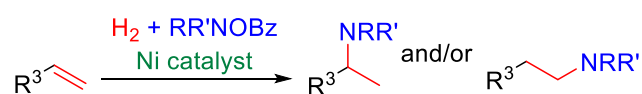
This project aims to develop new sustainable nanomaterials for catalysis using yolk-shell-structured magnetic mesoporous silica nanoparticles (NPs) as support, comprising a magnetic iron oxide core and a specific mesoporous silica external layer. A functionalization of the NPs mesoporous silica surface by organic ligands composed of N-heterocyclic carbene (NHC) and olefin moieties will allow the coordination of nickel(0) NPs of defined sizes and with unique catalytic properties. After characterizations (by microscopy MEB and TEM, XRD, XPS, DLS, Raman, ²⁹Si CP-MAS NMR, ICP and elemental analyses), the prepared materials will be applied as catalysts for hydrogenation and hydroamination of alkenes through an umpolung strategy for the latter. The catalysts recovery and reuse will be investigated thanks to their magnetic properties. Finally, the application of a non-contact electromagnetic inductive heating shall be also investigated in order to overcome energy losses and transfer limitations during the catalytic reactions by heating exclusively the nickel catalysts through the use of iron oxide NPs acting as a heat-transfer agent.



1) hydrogenation



2) umpolung hydroamination with electrophilic amines



References:

B. Louis et al. *Dalton Trans.* **2014**, 43, 3722 & C. Michon et al. *Chem. Commun.* **2023**, 59, 1537