

Offre de stage de M2 (2023)

Sorbonne-Université / Université Paris-Est

Preparation of a sequential microcolumns made of macroporous polymer monoliths combined with metal-organic frameworks for catalysis and in-line separation in continuous flow.

The multiporous catalysis/separation microsystem concerned in this project is composed of two connected microcolumns (Figure 1). The first one, dedicated to the enantioselective catalysis (C-C cross-coupling on the figure) is filled with a macroporous network made of interconnected polymer microglobules (Macroporous Polymer Monoliths, MPM) whose surface is covered with MOF nanocrystals, a class of highly porous hybrid materials built from the assembly of multifunctional organic linkers and metal ions. MOF are promising new material platforms for enantioselective catalysis owing to their tunable composition and the high density and dispersion of intra- or extra-framework catalytic sites within their structure. The second microcolumn, dedicated to substrates/products separation, is composed of MPM whose surface is modified with appropriate chemical functions.

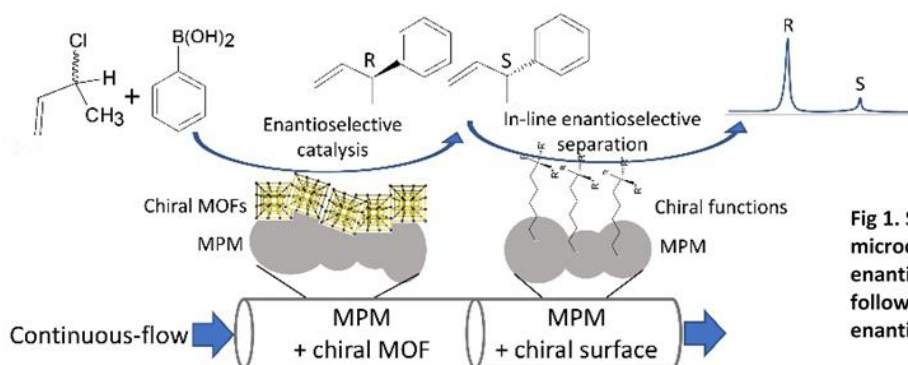


Fig 1. Scheme of the polyvalent microcolumn capable of enantioselective catalysis followed by an in-line enantioselective separation.

As a part of this project, and based on preliminary data, **the mission of the student will be to synthesize and characterize the MPM/MOF hybrid microcolumn for catalysis and functionalize the MPM surface of the separation section.**

Specific techniques or methods.

In order to characterize the hybrid micocolumns, different technics will be used : Infrared and Raman spectroscopy, powder X-ray diffraction, X-ray photoelectron spectrometry. The texture and porosity of the samples will be assessed by N₂ and Kr volumetric gas adsorption

and electron microscopy. The student will be trained and autonomous on most of the measurement apparatus and associated softwares.

The work will be carried out in the frame of a collaborative ANR project between the **Institut de Chimie et des Matériaux Paris-Est** belonging to the **Université Paris-Est (ICMPE)**, research group expert in the field of polymer science and continuous flow processes [1][2] and the **Laboratoire de Réactivité de Surface (LRS)**, located in **Sorbonne University**, a research group expert in the field of heterogeneous catalysis and MOF.

Web sites : <http://www.lrs.upmc.fr/fr/index.html> and <https://www.icmpe.cnrs.fr/>

Place where the internship will be achieved : mainly at ICMPE (Université Paris-Est).

Profile of the candidate : Master's degree student or Engineering school student with a background in chemistry and a strong interest (and already some knowledge about) for material chemistry and physico-chemical characterization of porous materials. Openness and curiosity, as well as motivation, autonomy and rigour are required.

Internship duration : 5-6 months starting from 1 February 2023.

Funding : monthly grant : 660 €.

PhD opportunity : a PhD grant is available at the outcome of the internship.

Application : applications must be submitted before 10th December 2022 (see contact below). A detailed CV, a recent letter of recommendation and a cover letter must be attached.

Contact : Dr Julien reboul, julien.reboul@sorbonne-universite.fr and Pr Benjamin Carbonnier, benjamin.carbonnier@cnrs.fr.

References

[1] M. Guerrouache et al., Functionalization of macroporous organic polymer monolith based on succinimide ester reactivity for chiral capillary chromatography: a cyclodextrin click approach, *Macromol. Rapid Commun.* 2009, 30, 109-113.

[2] AM. Khalil et al., Gold-decorated polymeric monoliths: In-situ vs ex-situ immobilization strategies and flow through catalytic applications towards nitrophenols reduction, *Polymer* 2015, 77, 218-226.