

DC7 – Job Vacancy

Position Description	
Reference	DC7
Title of the project	Tailored immobilization of soluble methane monooxygenases (sMMO) onto metal-organic frameworks (MOF) to synthesize bio-heterogeneous catalysts for light-chain alkane oxidation.
Recruiting Institution	CNRS (Lille, France)
PhD jointly awarded by	University of Lille (France) and Università Degli Studi Di Torino (Italy)
Additional secondment	ProfMOF (Norway)
Expected Start Date (estimated)	01-11-2023
Job Offer Description	
Keywords	soluble methane monooxygenases (sMMO), metal-organic frameworks, enzymology, heterogeneous biocatalyst, <i>in-situ</i> spectroscopy, high-throughput screening
Project Description	<p>The Doctoral Candidate will be hosted mainly at the Unit of Catalysis and Solid-state Chemistry (UCCS, Lille, France) and will be enrolled in the PhD school of the University of Lille, supervised by Dr. E. HEUSON. Part of the activity will be carried out during secondment periods, mainly at the ProfMOF company (Norway) under the supervision of Prof. K. P. LILLERUD synthesize the MOF used as support for the enzymes, as well as at Università Degli Studi Di Torino (Italy) under the supervision of Dr. N. BARBERO, to characterize the resulting bio-materials using advanced spectroscopy techniques.</p> <p>The project aims to immobilize the different subunits of soluble methane monooxygenases within the same material to make a heterogeneous biocatalyst that can be used in a continuous flow reactor for the oxidation of short-chain alkanes. More than just creating an efficient biocatalyst, this part of the DEMO project will focus on understanding the relationships between the enzyme subunits and their catalytic activity, and more importantly the influence of the MOF on the enzymes. This part will be supported by the development of advanced spectroscopy techniques for the characterization of the biomaterial according to the type of immobilization (surface or encapsulation). In order to maximize the number of different types of interaction between the enzymes and the support, several immobilization conditions will be screened using the robots of the REALCAT platform in Lille.</p>
Objectives	<p>Science:</p> <ul style="list-style-type: none"> • Test promising enzymes for CH₄, and respective sub-units, in large-pore MOFs developed by other DEMO partners as well as at ProfMOF. • Screen immobilization parameters using high-throughput equipment: MOF pore size, encapsulation method (impregnation, co-precipitation, covalent grafting, etc.), physicochemical conditions (solvent, temperature, salts), and sub-units ratios/disposition. • Evaluation of the activity of the best sMMO@MOF candidates and comparison to free enzymes. • In-depth characterization of the interactions between enzyme sub-units and MOF nature via <i>in-situ</i> spectroscopy. <p>Training: Basic concepts behind enzyme use in synthesis (kinetic parameters, reactivity, etc.).</p> <ul style="list-style-type: none"> • MOF synthesis and characterization (XRD, XRF, ICP, TEM). • Enzyme immobilization techniques and translation into capillaries. • Basics of programming automated equipment, based on robots for screening. • Advanced spectroscopy to characterize the MOF-enzyme interactions and folding by circular dichroism. Additional technical and



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Expected Results	<ul style="list-style-type: none"> • Successful immobilization of one sMMO onto a MOF prepared at ProfMOF, with a catalytic activity at least equivalent to free enzyme. • Catalytic activity of the bio-material characterized with respect to short chain alkanes, including its kinetic parameters. • Development of an efficient characterization approach for the study of sMMO@MOF providing insight on the interaction between the enzyme and its carrier.
PhD Supervisors	Dr. Egon HEUSON (Centrale Lille - CNRS, France) Prof. Karl Petter LILLERUD (ProfMOF, Norway) Dr. Nadia BARBERO (Università Degli Studi Di Torino, Italy)
Vacancy requirements	
Qualifications	Eligible candidates must hold or be in the process of gaining a second level degree (Master's Degree level or equal qualification) which gives access to Ph.D. studies, including Material Sciences, Biochemistry, Biotechnology, Biocatalysis, Chemical Engineering, Material Sciences or a related discipline.
Requirements	The candidate must be eligible for enrolment in the PhD program at the date of the recruitment. Additional information on specific requirements and eligibility criteria of the PhD School of University of Lille can be found at the following link: https://edsmre.univ-lille.fr/rejoindre-led/candidature
Languages	Successful candidates must have a high level of proficiency in written and spoken English, which will be assessed with a motivation letter and the interview, respectively. Basic knowledge of French and/or Italian is desirable.
Skills	The ideal candidate possesses: • a strong background in enzymology, material sciences, and if possible, in biotechnology; • propension to advanced material characterization techniques; • ability to adapt into multi-disciplinary work environments; • good team-working and communication skills. Knowledge of MOF synthesis and liquid handler programming is also an asset.
Experience	Documented research experience in the field of material sciences and enzymology, with an emphasis on biocatalysis, will be considered as a plus at the selection stage.
Job Details	
Salary	Salary follows the rules in Marie Skłodowska-Curie Actions Work Programme. Gross salary per month: 3957.6 € + 600 € mobility allowance
Other benefits	Other benefits: Gross family allowance: 495 € per month - if applicable* *The family allowance will also be made available to researchers whose parental status changes during their project.
Duration	36 months
Type of contract	Full time
Place of work	CNRS (Lille, France, 20 months) ProfMOF (Norway, 4 months) Università Degli Studi Di Torino (Italy, 12 months)



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