



COLLÈGE
DE FRANCE
—1530—



Postdoctoral Position Functionalized MOFs for the photoreduction of CO₂ and oxidation of water

**Position for 12 months (renewal possible) - Starting date Spring 2022
ANR Funding (salary upon experience)**

Collège de France, (LCPB, Director: Marc Fontecave) Paris, FRANCE

In the very active field of CO₂ reduction into valuable chemicals, semiconductors, molecular complexes and metal-organic frameworks (MOFs) - or their combinations - have been particularly considered for the photochemical CO₂ reduction reaction (CO₂RR). Importantly, MOFs based on metal clusters (nodes) and photosensitive organic ligands (linkers) which act as antenna upon illumination do not require additional noble metal-based photosensitizers (PSs), such as the largely used Ru(bpy)₃²⁺ for photocatalytic applications.

In the last five years, our team has focused more specific research efforts on MOF-based systems for photocatalytic applications. On the one hand, we have combined for the first time a cobalt-polyoxometalate (Co-POM) catalyst and the photosensitive porphyrinic MOF-545 to provide the first noble metal-free heterogeneous photocatalyst **for water oxidation**: the Co-POM@MOF-545 composite possesses remarkable water oxidation activities and recyclability under visible light illumination (*J. Am. Chem. Soc.* **2018**, *140*, 3613; *ACS Appl. Mater. Interfaces*, **2019**, *11*, 47837-47845). On the other hand, our group has also developed MOF-based materials towards **CO₂RR** using targeted functionalization strategies of porous solids (*ChemSusChem* 2015, *8*, 603-608; *Angew. Chem. Int. Ed.* 2020, *59*, 5116-5122, *J. Am. Chem. Soc.* 2020, *142*, 20, 9428-9438). We have recently proposed strategies for boosting photocatalytic CO₂RR properties of the porphyrinic MOF-545, while elucidating the unique mechanism at play.

The post-doc position proposed will build on the above recent findings in our team on MOFs functionalized for CO₂ reduction and water oxidation. Our ambition is to bring the above MOF-545-based catalysts into the realm of the photocatalytic reduction of CO₂ and oxidation of water, using the same material to perform both reactions. The modification of the MOF with the impregnation of targeted series of POMs as co-catalysts will be envisaged. Also we wish to develop gas phase photocatalysis in collaboration with IFPEN in Solaize (Lyon) to be compared with performances obtained in the liquid phase.

Collaborations involved : Institut Lavoisier de Versailles (ILV) - Dr. Anne DOLBECQ and Pr. Pierre MIALANE on MOF synthesis and characterization, POM chemistry. IFPEN at Lyon – Dr Audrey BONDUELLE and Dr. Celine PAGIS

Potential Candidates should have a strong background in materials science and catalysis:
- Background in porous solids (MOFs, zeolites, COFs, POPs...) chemistry is highly desirable
- Experience in photocatalysis would highly appreciated
- Excellent publication record

Personal Skills

- Autonomy and overall lab in-charge involvement,
- Demonstrated ability to work as a member of a team
- Demonstrated ability to organize own workload
- Ability to meet deadlines
- Clear and fluent report writing and oral communication
- Demonstrated ability to take ownership and responsibility for projects
- management of students, ability to supervise and train early stage researchers

Applications: Cover letter, detailed CV and contact information for three references should be sent to Dr. Caroline MELLLOT-DRAZNIÉKS (caroline-melllot-draznieks@college-de-france.fr) and Pr. Marc FONTECAVE (marc.fontecave@college-de-france.fr). Interviews will be proposed on reception of these required documents.