$MOFC^4M_2$

Innovative nanostructured **M**etal **O**rganic **F**rameworks/**C**arbon materials **C**omposite for post-combustion **C**O_2 capture by **M**oving Bed **M**icrowave Swing Adsorption process.

2 years post-doctoral co-joint position in Mons – University of Mons (Belgium) and in Paris - Institute of Porous Materials of Paris (IMAP) (France)
Starting : Now

Context:

Power generation and carbon-intensive industries are responsible for a large share of the anthropogenic CO_2 emissions to our atmosphere. Shifting towards a low-carbon economy needs cost-effective novel carbon capture solution (CCS) to be conceived, tested and deployed afterwards. Current solutions either suffer from high energy penalties like in amines-based absorption or simply cannot offer sufficient performances. **Adsorption process** is widely considered as a promising alternative for capture and concentration of CO_2 arising from large sources such as power plants and other energy intensive industries (*e.g.* cement, steel, iron, chemical or petrochemical industries). In this regard, capture of CO_2 from flue gas in post-combustion processes using **Metal Organic Frameworks (MOFs)** has been extensively studied. TSA cycles have also been tested with MOFs, showing that the energy required for regeneration is lower than for 13X zeolite for the same levels of purity and CO_2 recovery.
The combination of MOFs as sorbent and the **Microwave Swing Adsorption (MSA)** as the regeneration process is a promising method to decrease the energy penalty. MOFs usually exhibit very low electrical conductivity, associated with low dielectric losses and low microwave heating that would hamper their use for MSA processes.
By combining them with carbon materials, the electrical conductivity and the absorption of microwave can be significantly enhanced, which is of interest not only for CO_2 capture and regeneration by MSA process.

Area of the proposed research in this post-doc:

The main technological locks of project are as follows (i) able to produce composite MOF/carbon materials keeping good adsorption properties in real conditions (e.g. in presence of water vapor) and having adequate and adapted dielectric permittivity and conductivity, (ii) able to produce small beads (below mm of diameter) of selected composites with crushing strength higher than 10 N.

This tasks will consist in:

- Establishing conditions (use of design of experiments) to produce a series of MOFs/carbon black (MOFs/CB), MOFs/graphene oxide (MOFs/GO) or activated Carbon (MOFs/AC) composites at the gram scale to be used efficiently in the microwave heating reactor;
- Synthesis at larger scale and shaping of most promising MOFs-carbon materials composites;
- Systematic characterization of powder and shaped materials to ensure the quality of the MOFs-carbon materials composites by combining classical characterization techniques (XRPD, TGA, IR spectroscopy) and mechanical resilience, thermal conductivity, dielectric permittivity;
- Evaluation of CO_2 adsorption properties;
- CO_2 desorption on shaped materials by thermal heating and microwave heating.

Candidate's profile:

Education: The candidates should have a PhD in chemical or in process engineering.

Strong background in MOFs synthesis and on porous material characterization is required.

Languages: A good knowledge of English is required, both oral and written.

Other skills: Writing skills, good communication skills, rigor, conciseness and motivation.

The candidate will be hosted in active working environments under a challenging job in a dynamic and challenging innovative project. Salaries are in accordance with the internal university of Mons agreement (average 2500 net €/month).

Recruitment procedure:

Applications (CV + motivation letter showing the adequacy with the requested profile + eventual letters of recommendation) must be sent by email before January 10, 2022 to:

Prof. Guy DE WEIRELD: guy.deweireld@umons.ac.be ;
Dr Christian Serre: christian.serre@ens.psl.eu

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