

PERSONNEL SCIENTIFIQUE

Post-Doctoral position (f/m/x) - DECARBOWAL - CRUCIAL - SORBINNOV PROJECT - Innovative adsorbents investigation for carbon capture

Votre mission

Context:

The work will be carried out at the Faculty of Engineering (FPMs) of UMONS in the framework of the “SORBINNOV project” funded by the FEDER/ERDF (European Regional Development Fund). The project is included in a project portfolio named “DECARBOWAL”. It concerns the thematic of carbon capture.

Indeed, reducing the CO₂ emissions is mandatory to meet the objectives in terms of greenhouse gas effect limitation, but implementing carbon-negative solutions is also a necessity will still have “unavoidable CO₂ emissions” for several years. Such operation is possible thanks to the Direct Air Capture (DAC) of CO₂. The SORBINNOV project is focusing on two CO₂ capture technologies, applicable to both the industrial flue gases (CO₂ contents from 5% to 30%) and the air (CO₂ content around 0.04%), gas-solid adsorption and the gas-liquid absorption. The present offer is related to the adsorption technology.

More precisely, as the core of the adsorption CO₂ capture technology is the adsorbent material, investigating new adsorbents and/or new shaping is still mandatory in order to develop a more economically competitive technology, allowing to capture the CO₂ with a high recovery rate and to recover a CO₂ as pure as possible. Different classes of adsorbents exist to capture CO₂, and they are at very different stages of technological development. For example, we can mention activated carbons and zeolites as well as, various classes of MOFs (Metal Organic Frameworks) or porous solids, grafted or impregnated with amine groups, which are innovative adsorbent materials with high promising potential.

The objective of the works will be to determine material specifications. Establishing (or validating) KPIs for monitoring adsorbent performance as a function of applications (CO₂ adsorption capacity, CO₂/N₂ selectivity, heat of adsorption), stability in the presence of contaminants, in order to draw up and up-to-date list of candidate MOFs and porous solids grafted or impregnated with amines. The status of patents
Cookies the structure of each material, synthesis and scale-up while limiting environmental impact (use of

aqueous solvents non-toxic metals), as well as shaping, will also be analyzed and considered as key parameters for the project. The selection of MOFS will be based in particular on developments carried out in the H2020-MOF4AIR project (Metal Organic Frameworks for Carbon Dioxide Adsorption Processes in Power Production and Energy Intensive Industries – <https://www.mof4air.eu/>), coordinated by UMONS.

Area of the proposed research:

For reaching the project objectives, the following tasks will be performed:

- updated technological reviews on adsorption-based carbon capture systems and especially on the innovative adsorbent materials: 2 or 3 promising adsorbents will be selected as potential candidates for experiments;
- validation the selection of the best MOFs for CO₂ capture, both for application to industrial flue gases (CO₂ contents from 5% to 30%) and for the capture of ambient air application (CO₂ content around 0.04%) from the list of potential candidates;
- characterization of a set of selected samples on a few grams scale in powder form: pure-component adsorption isotherms, mixed-components breakthrough curves: evaluation of working capacity, CO₂/N₂ selectivity, regeneration performances (via TSA – Temperature Swing Adsorption, (V)PSA – (Vacuum) Pressure Swing Adsorption), stability under a flow considering different gas mixtures (gas concentration, presence of water, contaminants (SO_x or NO_x), temperature, etc.);
- in a second phase, shaping tests will be carried out to find the most plausible formulation in terms of mechanical stability, working capacity, pressure drop of the shaped adsorbents, giving optimum volumetric adsorption capacity for CO₂ adsorption capacity and CO₂/N₂ selectivity of the chosen materials. Co-adsorption isotherms, as well as breakthrough curve experiments will be carried out to study concurrent adsorption, mass transfer and heat transfer parameters, and to measure kinetic constants for the adsorption of the various components.

The post-doctoral works will also naturally include different dissemination activities: reporting, scientific publications and presentations in international conferences.

During the works, several exchanges will be necessary with internal collaborators (PhD students, post-docs, etc.) and also with external collaborators such as other universities or research organisms, industrials, technology providers, etc.

Votre profil

Education: Candidates must hold a PhD degree in Chemical engineering/Chemistry/Engineering Sciences or fields (such as industrial chemistry, mechanical/ environmental engineering, ...) with a strong interest in chemistry, energy, environment, process engineering. Any previous experience in relation with carbon capture, especially by adsorption, would be an asset.

Languages: A good knowledge of English is required, both oral and written; a knowledge of French would be an asset.

Cookies

Other skills: Any experience related to adsorption tests and adsorbent characterization would be an asset.

Writing skills, good interpersonal and communication skills, rigor and conciseness will be highly appreciated.

Notre offre

The candidate will be hosted in a nice working environment under a challenging job at a dynamic and ambitious University, and in a context with several other PhD students/Post-docs working on carbon capture and utilization. Salaries are in accordance with the internal University agreement.

The Post-Doc is expected to start as soon as possible in 2024 for a duration of 18 months.

Intéressé(e) ?

Applications (CV + motivation letter showing the adequacy with the requested profile + eventual letters of recommendation) should be sent by email to:

Prof. Guy DE WEIRELD: guy.deweireld@umons.ac.be ; +32(0)65/37.42.03

Thermodynamics Unit

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After a first selection based on the CV, the recruitment procedure will include minimum two interviews comprising a first remote interview by Microsoft Teams or phone, and a second interview (ideally in live at UMONS) including a short presentation by the candidate.

UMONS aims to be a diverse and inclusive community. Job vacancies respect the principle of non-discrimination and the recruitment procedure guarantees fair treatment of applications regardless of the gender, presumed race or ethnic origin, social origin, religion or beliefs, disability, age, sexual orientation or political opinions of applicants.

Lié à Faculté Polytechnique	Type d'emploi Post-Doctoral position (f/m/x)
Contrat determined	Date de publication 08 mars 2024
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Informations de contact

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