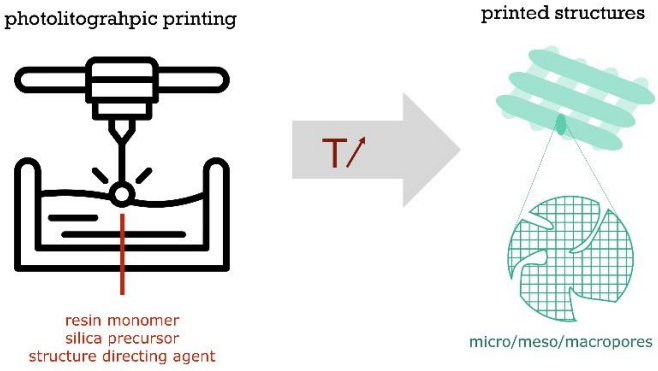
3D-Printed Mesoporous Silica Adsorbents for the Capture of CO_2 from Dilute Sources

PhD Position

Context & Objectives. To keep global warming limited, greenhouse gas emissions must decrease dramatically and the net removal of CO_2 from the atmosphere will be key. Adsorption of CO_2 on solid adsorbents forms is one of the key technologies currently under development, with a large industrial interest. CO_2 is captured in a solid, porous material. The CO_2 is subsequently removed by decreasing pressure or heating, on which the captured CO_2 can be recovered. A major challenge lies in the capture of CO_2 from dilute sources: for example, natural gas combustion cycles and directly from ambient air.

A recent trend exists towards using these solid adsorbents in the form of monoliths. The use of monoliths allows to optimise pressure drop, heat and mass transfer across the adsorbent vessel. Classically, they are prepared via extrusion. Such monoliths contain only channels parallel to the gas flow.

The emergence of 3D-printing allows to obtain a much larger structural variety and opens possibilities to test exciting new geometries. With these possibilities, come new research questions: which geometries can be prepared? Which geometries allow to optimise heat transfer, mass transfer and pressure drop? This PhD project has the objective to answer to these questions. It aims to develop 3D-printed structured adsorbents using stereolithographic (SLA) printing for carbon capture applications. The PhD has as objectives: (i) to prepare CO_2 selective adsorbents using SLA printing and (ii) to evaluate the potential of these structures for CO_2 capture applications.



Partners. The PhD project is a collaboration between the MADIREL and ICR laboratories of Aix-Marseille University and the Department of Chemical Engineering of Vrije Universiteit Brussel (VUB). The ICR bring expertise to the table regarding the synthesis of adsorbents. The MADIREL laboratory has a large expertise in the evaluation of porous materials for gas adsorption. The project includes a research stay at the Department of Chemical Engineering at VUB, Brussels, for the evaluation of prepared materials. A member of TotalEnergies will act as a mentor for the PhD candidate, giving both scientific and career input.

Profile. The candidate should have a Master of Science in Chemistry, Physical Chemistry or Chemical Engineering. He/she should have a solid background with good grades. The candidate should have spent less than 12 months in France in the 3 years preceding the call.

Renumeration. The PhD gross salary is € 3224 / month, with additional € 300 / month mobility allowance and € 660 /month family allowance (under certain conditions).

Application Procedure. Prospective candidates should apply via the SCHADOC website: https://schadoc.univ-amu.fr/en/call-candidates/climate-change-environmental-challenges/3D_CAPCO2

Applications are welcome until 21st of April 2025. A firs selection of candidates will take place between April 22nd, 2025, and May 23rd, 2025. Final interviews for project and candidate selection will take place between 26th May 2025 and 20th June 2025. All details can be found on the SCHADOC website: https://schadoc.univ-amu.fr/

Contact details. The PhD thesis will be jointly supervised by Dr. B. Claessens (MADIREL - benjamin.claessens@univ-amu.fr) and Pr. E. Besson (ICR - eric.besson@univ-amu.fr).