



## PhD Position – CO<sub>2</sub> sequestration and development of new, low-carbon cementitious binders through mineral carbonation of industrial, mining and demolition wastes.

**Institutions :** Laboratoire Matériaux et Durabilité des Constructions (Université de Toulouse / INSA Toulouse) & Laboratoire Géosciences Environnement Toulouse (CNRS / Toulouse)

**Starting Date :** Septembre 2025 for 3 years

### Context

The CO<sub>2</sub> emissions of cement production represent some 7% of global CO<sub>2</sub> emissions. All plausible scenarios in the IPCC AR6 report to achieve the 'net zero' emission target by 2050, include some amount of carbon capture and use or storage (CCUS). The carbonation of high-volume silicate waste materials offers the opportunity to at the same time sequester CO<sub>2</sub> and produce reactive materials that can be used to replace cement. This approach was proven to be technically feasible, with first demonstrators being built, but there are still technical challenges, especially for Mg-silicates that require higher carbonation temperatures and CO<sub>2</sub> pressures.

### Project environment

The CARBIOCEM project tackles the challenges of Ca/Mg-silicate carbonation by introducing microorganisms to catalyze the reaction of different waste materials. The project is funded by the French National Research agency (ANR) through the PEPR program "Support for the development of new decarbonized industrial processes", for 4.5 years starting April 2025. The project consortium brings together research laboratories from biogeochemistry, ecology, biotechnology, material sciences and civil engineering to (1) evaluate and develop bioprocesses for the carbonation of industrial by-products and (2) the development of methodologies for the production of ultra-low-carbon cementitious materials. Besides academic research labs, industrial partners associated to the project will ensure quick knowledge transfer of project results.

### Missions

The future PhD student will integrate the Carbiocem project at the LMDC Laboratory and will be responsible for the physico-chemical characterization of both, raw materials and carbonated materials. He/she will further conduct abiotic carbonation trials in order to determine desired properties of carbonated cementitious. Furthermore he/she will screen the cementitious reactivity of the

carbonated materials of all partners and participate in the formulation and testing of low-carbon cementitious binders based on carbonated waste materials. Common techniques to be applied are XRD, FTIR/Raman, TGA, SEM, NMR and calorimetric measurements. The PhD will work closely with project partners. He/she will participate and lead publication of project results in form of patents, international scientific journals, conferences and technical committees. The interdisciplinary nature of the project with academic and industrial partners will open the opportunity to integrate different fields of high industrial and societal impacts.

### Qualifications

- Master's degree in geochemistry/materials chemistry/civil engineering or related fields
- Interest in environmental issues and curiosity for engineering solutions
- First experience lab-work and some of the analytical techniques will be appreciated.
- Good communication skills and willingness to integrate an interdisciplinary team
- A good written/oral command of English is an asset.

For any **questions** and **application** for this PhD position please **contact**:

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