

## Master 2 Internship offer - Development of reactive materials in low carbon footprint binder from liquid wastes containing sulphate

**Starting date:** February 1<sup>st</sup> 2024 for 5 to 6 months

**Contract:** 5 to 6 months internship offer, Université Gustave Eiffel SIE doctoral scholarship, 567€ monthly gross wage + half the price of public transport subscription

**Localisation:** Champs-sur-Marne (77), France, in CPDM Laboratory (Physico-Chemical Behaviour and Material Durability), in MAST Division (Materials and Structures) of Université Gustave Eiffel

**Research field:** Physico-chemistry of materials

### Internship subject:

Several industries -nuclear, chemical, sewage or agriculture- produce sulphates containing bi-products. Due to the risk of ecological problems, sulphates containing produces are, for now, considered as wastes with a need to get rid of them. In the best way, they are used as a mean to precipitate metals or as a fertiliser for food production. Considering the produced quantity of these bi-products and their composition, an interesting path would be to have them used directly as a raw material, such as in construction. However, an important quantity of sulphate  $\text{SO}_4^{2-}$  can be detrimental to cement hydration (hydration delay, difference of hydrates produced) or induce pathologies at different age (Delayed Ettringite Formation – DEF) (Colleparidi 2003), with possibility to be harnessed to generate beneficial phases to ensure the long-term integrity of the resulting cement waste form.

Considering that, the objective of this internship is to try out varying the sulphate content in a simulated liquid waste as a reactant in a cementitious material leading to hydration, setting and targeted mineralogy. The evolution of mineralogy, activation, hydration and mechanical properties will be monitored with time. An effort will be focused on tracking the mineral changes during setting and how they evolve with time, with if possible the reach of an optimum regarding such phases.

### Who are we?

CPDM laboratory (Physico-Chemical Behaviour and Durability of Materials) in MAST department (Materials and Structures) of the Université Gustave Eiffel at Marne-la-Vallée (France), conducts research projects and judicial assessments on different materials used in civil engineering (cementitious and alternative materials, bio-based materials and polymers). Specifically on cementitious materials, CPDM laboratory has several experts working on formulations and their impact on hydration, mineral, chemical and physical characterisation, material implementation, initial to long term performances comprehension and durability testing against internal and/or external attacks.

### Candidate profile:

The internship candidate should be in engineer or research master study, specialised in mineral materials and physico-chemical characterisation or civil engineering, with a preference for cementitious materials. Knowledge in

formulation and characterisation (mineral analysis; reaction kinetic analysis; or mechanical and durability analysis) and English skills would be highly appreciated. The use of regular office software is a necessity. The internship candidate should be attracted by experimental and team work.

**Contact(s):**

Please send resume, cover letter and grades for M1 and M2 to:

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**Key words:**

Cement, formulation, mineral incorporation, durability, sulphate containing waste

**References:**

Collepari, M. (2003). "A state-of-the-art review on delayed ettringite attack on concrete." Cement and Concrete Composites **25**(4-5): 401-407.