

UNIVERSITY: Lille , Faculty of Sciences and Technologies

Scientific field : Chemistry, Physical Chemistry

Title of the thesis: Synthesis and characterization of composites allowing the incorporation of cutting fluids in geopolymers

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Laboratory:

UCCS - Unité de Catalyse et de Chimie du Solide (UMR CNRS 8181), Cité Scientifique, Villeneuve d'Ascq

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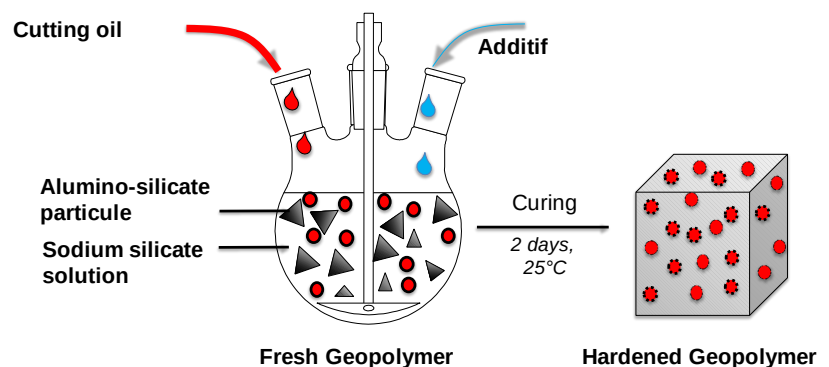
Related research project (international/national/regional): 50% Centrale Lille Institut / 50 % CEA

Expected/obtained funding:

ABSTRACT

The operation of nuclear facilities generates a wide variety of potentially radioactive waste, such as certain non-incinerable organic liquids (oils). A very large part of this low and intermediate level waste does not currently have a final disposal solution. Recently studies at CEA Marcoule have shown that geopolymers are an alternative to the usual silica-calcium cement. Indeed, geopolymers have a hardening mechanism based on a polycondensation of alumino-silicate buildings, which makes them compatible with the incorporation of oil in large quantities, except for cutting oils.

Cutting oils are microemulsions which also contain water, surfactant and co-surfactants. For this, they are also called cutting fluids.



The objective of the thesis will be to find a process for incorporating these Cutting Fluids (CF) into the fresh geopolymer in the form of fine droplets, and to maintain this state of immobilization during the hardening phase. The direct incorporation of CF will be studied, as well as the oil contained in of CF.

For this, the separation of the oily and aqueous parts of the CF microemulsions will be carried out by accessing the stable thermodynamic states (Winsor I, II, II) by various chemical processes. The influence of parameters process such as the stirring speed, oil flow rate, additive, order of addition, etc... will be analyzed, as well as the state of confinement of the FC (or of the FC's oil) in the fresh and hardened geopolymer.

Planned recruitment date : end of 2020, beginning of 2021

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Additional remarks/comments :

Keywords: Formulation, Microemulsion, Process, Rheology, Zeta potential, laser granulometry, DLS, Optical microscopy, Scanning Electron Microscopy, Interfacial tension

Location: The thesis will take place in the Cité Scientifique, Villeneuve d'Ascq (with short-term assignments at CEA Marcoule)