MASTER DE CHIMIE DE PARIS CENTRE - M2S2
Proposition de stage 2021-2022
Internship Proposal 2021-2022

Parcours type(s) / *Specialty(ies) :*
☐ Chimie Analytique, Physique et Théorique / *Analytical, Physical and Theoretical Chemistry* :
☐ Chimie Moléculaire / *Molecular Chemistry* :
☐ Chimie et Sciences Du Vivant / *Chemistry and Life Sciences* :
X Chimie des Matériaux / *Materials Chemistry:*
☐ Ingénierie Chimique / *Chemical Engineering:*

Laboratoire d'accueil / *Host Institution*
Intitulés / *Name* : Laboratoire Sciences et Ingénierie de la Matière Molle (SIMM)
Adresse / *Address* : 10 rue Vauquelin, 75231 Paris Cedex05
Directeur / *Director (legal representative) :* Etienne BARTHEL
Tél / *Tel* : 01.40.79.44.22
E-mail : etienne.barthel@espci.fr

Equipe d'accueil / *Hosting Team :* Colloids, Assemblies and Interfacial Dynamics (CAID)
Adresse / *Address :* 10 rue Vauquelin, 75231 Paris Cedex05
Responsable équipe / *Team leader* : Nicolas SANSON
Site Web / *Web site :* https://www.simm.espci.fr/-CAID-Colloids-Assemblies-and-Interfacial-Dynamics-.html
Responsable du stage (encadrant) / *Direct Supervisor :* N. SANSON, J.-B. d'ESPINOSE
Fonction / *Position :* Maître de conférences, Professeur, Doctorant
Tél / *Tel* : 01.40.79.44.17
E-mail : nicolas.sanson@espci.fr; jean-baptiste.despinose@espci.fr

Période de stage / *Internship period* * : 01/02/2022-01/07/2022

Polymers for green cements: a new chemistry to reduce the environmental impact of cements

Projet scientifique (1 page maximum) / *Scientific Project (maximum 1 page):*

Keywords: polymer synthesis, polymer conformation, adsorption, low-CO_2 cement

Scientific description:
Cement production is responsible for about 7% of worldwide CO_2 emission. There is thus an urgent need to reduce the carbon imprint of cement and this leads to the conception of totally new mineral binders based on industrial by-products. However, these new cements need to be chemically activated by an alkali solution.[1]
As it turns out, the polymers used by the cement industry to fluidify cement pastes are inefficient in green cements. A PhD candidate currently working on this topic in our laboratory as shown that this is largely because the conformation and solubility of polymers change in alkali solutions.[2]
This project thus aims at designing new polymer architectures with controlled conformation at high alkali ionic strength.

* min. 5 mois à partir du 31 janv 2022 / *min. 5 months not earlier than January, 31st 2022.*
Fin de stage au plus tard le 15/07/2022 ou le 30/09/2022 (dates de validation de diplôme). / *End of internship at the latest July 15, 2022 or Sept. 30, 2022 (dates of graduation).*

We are looking for an intern to study the synthesis and conformation of such polymers as well as assess their impact on the rheology of activated cement pastes. This is thus a highly multidisciplinary topic that will be carried on in conjunction with a PhD candidate and an industrial group active in the field of construction materials. Besides working daily with the PhD candidate, the student will have to interact and report to the industrial partner. Good communication skills are thus required.

[1]. Palacios, M., S. Gismera, S., Alonso, M. M., d'Espinose de Lacaillerie,J.-B. & Lothenbach B. Early reactivity of sodium silicate-activated slag pastes and its impact on rheological properties. Cem. Concr. Res. 140, 106302 (2021)
[2]. Giraudeau, C., d'Espinose de Lacaillerie, J.-B., Souguir, Z., Nonat, A. & Flatt, R. J. Surface and Intercalation Chemistry of Polycarboxylate Copolymers in Cementitious Systems. J. Am. Ceram. Soc. 92, 2471–2488 (2009).

Techniques/methods in use: polymer synthesis, NMR, Size exclusion chromatography (SEC), light scattering, FTIR, rheology, zetametry, TOC (Total Organic Carbon).

Applicant skills:
- General knowledge of polymer synthesis and characterization
- General knowledge of the physical chemistry of colloids
- Experimental skills
- Reporting and communication skills

Industrial partnership: Yes (confidential)

Internship supervisor(s) (name, email, phone, webmail):
N. Sanson (nicolas.sanson@espci.fr), J-B. d'Espinose (jean-baptiste.despinose@espci.fr), C. Paillard (clara.paillard@espci.fr)
Internship location: Soft Matter Science and Engineering (SIMM) laboratory at ESPCI, a joint CNRS-ESPCI-SU laboratory, 10 rue Vauquelin 75005 Paris

Possibility for a Doctoral thesis: Yes. Several PhD openings are expected next year with a European consortium funded by the industry.