MASTER DE CHIMIE DE PARIS CENTRE - M2S2
Proposition de stage 2024-2025
Internship Proposal 2024-2025

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* : Sciences et Ingénierie de la Matière Molle
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Responsable équipe / *Team leader* :
Site Web / *Web site : https://www.simm.espci.fr/*
Responsables du stage (encadrants) / *Direct Supervisors :* Cécile Monteux/Etienne Barthel/Alba Marcellan
Fonction / *Position :* Directrice de recherches CNRS
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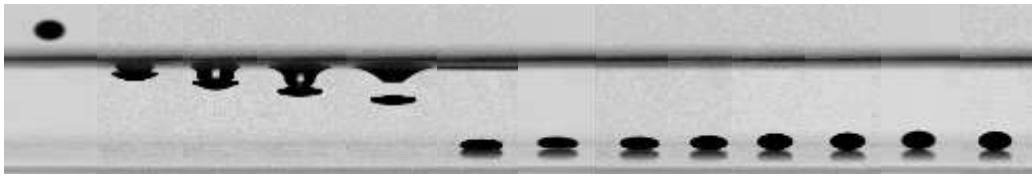
Période de stage / *Internship period* * : Janvier-Juin 2025

Impact de gouttes gélifiantes pour l'encapsulation

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

The GENNIAL ANR project, which involves ESPCI, Mines Paris Tech and Sao Paulo State University, aims at understanding the mechanisms at play during the gelation of a droplet of polymer solution impacting a liquid bath filled with a cross-linker molecule. During this process the cross-linker molecules diffuse through the drops and reacts with the polymer molecules to form an elastic crust which grows over time.

In a previous article we have shown experimentally using a high speed camera that the droplets elongate as they hit the bath and then become spherical over time. Combining analytical model and numerical simulations we have shown that this shape relaxation is due to an interfacial tension, of elastic origin, caused by the expulsion of water from the gelled bead [1].



* min. 5 mois

The internship/thesis project will consist in studying this gelation process in a model geometry [2] to observe to osmotic flow of water going from the polymer solution to the bath containing the cross-linker molecules. We will also quantify the growth of the gelled layer using fluorescence imaging, as well as the velocity of the osmotic flow using tracer particles. We will vary the amplitude of the elastic stress at the drop / bath interface by varying the concentrations of polymer molecules and cross-linker.

Depending on the interest and profile of the student we can orient the project either toward numerical simulations or toward the study of new types of interactions such as the complexation of polymers through non covalent interactions [3].

Techniques used : caméra rapide, rhéologie, mécanique

Collaborations

A. Pereira and E. Hachem (Mines Sofia Antipolis) & Sao Paulo State University
Thesis funding is secured by ANR GENNIAL

References :

[1] Godefroid, Marcellan, Barthel, Monteux, « Shape and stress relaxation in gelling drops », Soft Matter, 2023
[2] Emilie Guilbert, Clément de Loubens, Alice Vilotte, Christophe Schmitt, Deniz Gunes,and Hugues Bodiguel, « Spontaneous Structuration of Biohydrogels by Membrane-Free Osmosis », Advanced Functional Materials, 2024
[3] de Baubigny, J. D. , P. Perrin, N. Pantoustier, T. Salez, M. Reyssat, C. Monteux*. Growth mechanisms of polymer membranes by H-Bonding at immiscible liquid interfaces, ACS MacroLetters, (2021) 10 204−209, DOI: 10.1021/acsmacrolett.0c00847