

## Laboratoire Ingénierie des Matériaux Polymères - UMR 5223

Université Jean Monnet  
Campus Métare  
23 RUE Dr Paul Michelon  
42023 SAINT-ETIENNE (FRANCE)

8<sup>th</sup> March 2024

### PhD position (36 Months)

#### *Design of binary mixture of isotropic and anisotropic bio-based colloids*

**Research project:** Colloids present a rich landscape of nano-objects, varying in shape and density, which provide numerous opportunities for adjusting the rheological properties of colloidal suspensions. They can be classified according to their form factor and their softness. Colloid can be isotropic, such as silica particles (hard spheres), or anisotropic, such as cellulose nanofibers. The versatility of polymer architectures gives access to soft colloids presenting different levels of elasticity and inter-penetrability, such as microgels, star polymers and core-shell particles. Although the suspension behaviour of model single-shaped colloids has been widely reported, colloidal mixtures remain virtually unexplored. Previous works in our team has produced a variety of soft and hard isotropic binary colloidal systems with tuneable interactions based on supramolecular bonds.

The objectives of this experimental PhD project are to design mixtures of isotropic and anisotropic bio-based colloids, to investigate widely their behaviour in terms of phase diagram, rheological and structural properties. This model bio-based binary systems will be formulated from chitosan microgels (isotropic colloids) and chitin nanofibers (anisotropic colloids). Fundamental aspects will be addressed regarding the influence of isotropic/anisotropic ratio on the liquid-solid transition, the accessible organized phases and birefringence properties. Those properties are crucial for innumerable applications.

This project will be integrated within the laboratory IMP (Université Jean Monnet). The IMP team is renowned for his research activities in polymer science, with important facilities. Its main research aim is to establish and to control relationships between chemistry, structure, rheology, and processing.

**Candidate profile:** Highly motivated students with a Master/Ingénieur degree, or equivalent, in the field of polymer or colloids science (physical-chemistry) are encouraged to apply. A prior knowledge on chitosan, rheology or scattering techniques will be also appreciated. Excellent writing and oral communication skills.

**Application:** Send to the contact below your CV, cover letter, grades, and qualification (achieved and/or expected), **before the 15<sup>th</sup> of April 2024**

**Duration:** 36-months contract, from September-October 2024

**Salary:** ~1800 €/month

**Location:** France, Saint-Etienne, with regular travel at Lyon

**Supervisors:** Dr. Fabien Dutertre and Prof. Jean-Charles Majesté

**Contacts:** [fabien.dutertre@univ-st-etienne.fr](mailto:fabien.dutertre@univ-st-etienne.fr) and [majeste@univ-st-etienne.fr](mailto:majeste@univ-st-etienne.fr)

