PROPOSITION DE SUJET DE THESE
Campagne 2018/2019

Cible : étudiants Chinois à des thèses à l'ENS de Lyon
Diffusion : en Chine, via la plateforme du CSC

ECOLE DOCTORALE école doctorale de Physique et d'Astrophysique (PHAST)

TITRE DU SUJET DE RECHERCHE : Structure and dynamics of "smart" gels

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Lab Language/ Langue de travail: anglais/français

Abstract/Présentation du sujet :
Gels are self-assembled colloidal systems forming a solid network, even at low concentrations, thanks to attractive interactions [1]. Latex gels have spectacular mechanical properties: they harden strongly when subjected to mechanical stress. This behavior, also observed in other materials such as collagen, is still not well understood from a fundamental point of view.
First we will experimentally explore this phenomenon of stress hardening to determine the mechanisms at the colloid scale. Using a fluorescence microscope coupled to a mechanical shear cell, the candidate will first study the microscopic dynamics involved in the formation of the latex gel at rest and then the evolution of its structure under stress.
Then we will focus more generally on "dual-gels", systems composed of two different colloids whose gelling leads to entangled networks that offer an additional versatility compared to single-component gels (see figure below). In particular, we will seek to combine stress hardening with other properties such as self-healing or fluidization to formulate "smart" gels.

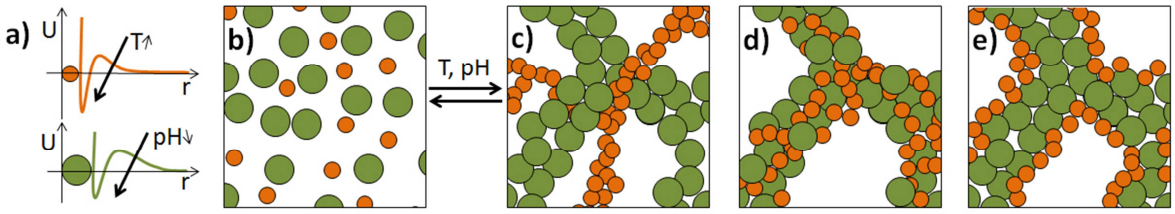

Figure – Protein dual-gel composed of proteins aggregating under the influence of temperature or pH (a, b) and which can lead to different microscopic architectures (c, d, e).

Experimental techniques: Video microscopy, rheology, image analysis in matlab

References:
[1] Hierarchical wrinkling in a confined permeable biogel. M Leocmach, M Nespoulous, S Manneville, T Gibaud, Science Advances 1 (2015)

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