

'Physique et Chimie des Matériaux' – ED 397 – année 2018
Proposition pour allocation de recherche,

Unité de recherche (nom, label, équipe interne): Sciences et Ingénierie de la Matière Molle (SIMM), UMR 7615 (ESPCI/Sorbonne Université/CNRS)

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Directeur de l'Unité : Christian Frégnigny

Etablissement de rattachement : Sorbonne Université / ESPCI

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Nombre de doctorants actuellement encadrés et années de fin de thèse : 1 thèse co-encadrée à 50% (fin prévue : 09/2019)

Co-encadrants : Nicolas Sanson (nicolas.sanson@espci.fr)

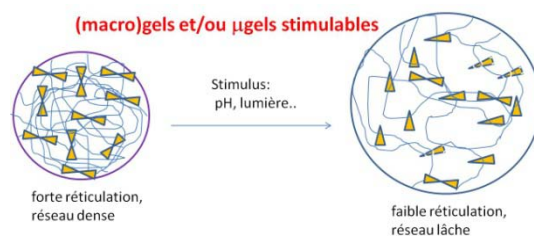
Thème C : Matériaux polymères : organisation et propriétés, nouvelles architectures

Titre de la thèse: Micro- and macro-gels with stimuli-responsive crosslinking density

Description du projet:

During the last three decades micro- and macrogels have received considerable interests for applications in many areas including material science, drug delivery, biosensors ...⁽¹⁻³⁾ Macrogels and microgels exhibit a 3D network structure that swells in a suitable solvent. Unlike macrogels, microgels are defined as colloidal gel particles of approximately 0.05 to 1 μm . Challenging research has been directed towards the synthesis « stimuli-responsive » or « smart » micro/macro-gels which properties can be reversibly modulated in response to an environmental *stimulus* such as pH, temperature, light... To achieve this, both micro- and macrogels need to bear suitable chemical functions to target the desired properties in relation to applications.

Within this framework, our research team is interested to the synthesis and functionalization of micro/macro-gel to control their swelling as well as their rheological/mechanical properties by changing their crosslinking density under stimulation as illustrated below.



The project is thus structured around three cornerstones: (i) the synthesis and characterization of functionalized micro/macro-gels using (mainly) conventional radical polymerization. (ii) the physico-chemical characterization of the responsive gels depending on the chain environment. Typically, the swelling and rheological/mechanical behavior of the gels will be investigated with respect to their microscopic structures, which can be changed under the action of various stimuli.

References:

- (1) Saunders B. et al., *Advances in Colloid and Interface Science* **1999**, 80, 1.
- (2) Nayak S. et al., *Angewandte Chemie International Edition* **2005**, 44, 7686.
- (3) Oh, J.K. et al. *Progress in Polymer Science* **2008**, 33, 448.