PhD position available in Montpellier, France
Polymer chemistry, physical chemistry, soft matter

Subject of the thesis: Co-assembling of double hydrophilic block copolymers: multicomponent polyion complex micelles

Abstract: The aim of the project is to study the micellization (co-assembling) and the lyotropic behavior of polyelectrolyte complexes obtained from double-hydrophilic block copolymers (DHBC). Mixing two polyelectrolytes of opposite charges in water lead to phase separation (coacervation). To maintain the coacervate in a colloidal form, DHBC rather than homopolypelectrolytes are used. In addition to the polyelectrolyte sequence, DHBC carry a neutral block which limits the size of the complexes at the nm scale and lead to so-called polyion complex (PIC) micelles [1]. PIC micelles form and dissociate through pH or ionic strength control. They are used as nanoparticles for medical applications in drug delivery [2]. We are interested in PIC micelles as functional templating agents to design ordered mesoporous silica materials [3, 4]. To gain versatility in both applications, it is necessary to combine several types of DHBC but this raises the question of their distribution in the system: What is the distribution of micellar composition? Do DHBC segregate within a mixed micelle?

The project encompasses synthesis as well as physico-chemical characterizations. A range of double hydrophilic block copolymers (DHBC) with different functional groups will be synthesized by controlled radical polymerization, in particular by RAFT technique [5]. The formation of PIC micelles in water will be studied with special attention to composition and internal fine structure of the micelles using various physico-chemical techniques such as potentiometry, capillary electrophoresis, osmometry, scattering techniques, fluorescence and NMR spectroscopy.

The proposed PhD project is part of the four year ANR project MESOPIC starting end of 2015 and coordinated by C. Gerardin, Institut Charles Gerhardt, Montpellier and which aims at developing eco-friendly routes to multifunctional mesoporous materials.

Candidates should hold a Master degree in chemistry or physical chemistry or an equivalent diploma from a Chemistry School. CV, letter of motivation and recommendation letters to be sent to martin.in@univ-montp2.fr and patrick.lacroix-desmazes@enscm.fr.

References:

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