


Internship proposal 2009-2010

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Microfluidic generation of polymer vesicles

Scientific project :

Polymersomes are vesicles formed by amphiphilic polymer assembly. Like for liposomes, the membrane bilayer of the polymer vesicle enables solute encapsulation by delineating an intravesicular medium isolated from the outer medium. However, polymer vesicles show an enhanced stability and a decreased permeability with respect to lipid vesicles, which makes them very attractive as chemical micro-reactors. Moreover, the diblock copolymer chemistry allows one to vary the membrane properties, and in particular the permeability properties, far beyond what is possible for lipids.

Our laboratory considers polymersomes as a model system allowing us to test our understanding of biomineralization, a process which leads in nature to the formation of nanostructured materials like bones, teeth or mollusc shells. As a matter of fact, controlled biological mineralization occurs in closed compartments wherein the mineral supersaturation is under cellular control and is actively increased so as to induce precipitation. In order to study the influence of confinement on precipitation reactions, we wish to produce vesicles of monodispersed size. A high monodispersity cannot however be obtained by classical techniques of vesicle production (sonication, electroformation, extrusion). We therefore want to develop a microfluidic device to generate polymer vesicles of highly controlled diameter size. Its design will be inspired from the work of Takeishi's group (Funakoshi et al, JACS **129**: 12608 (2007)). It may moreover integrate other functionalities like vesicle extrusion and osmotic shock generation.

The proposed work will require the use of microfabrication techniques (optical lithography, use of PDMS polymer, etc.) for making the microfluidic device, and the use of optical microscopy and light scattering techniques for the characterization of the vesicles produced. This Master work may be pursued within the framework of a PhD thesis, possibly with CEA funding.

Techniques in use :

Microfabrication techniques (optical lithography, PDMS polymer, etc.), optical microscopy, light scattering.

Applicant skills :

Experimental skills are required as well as some basic knowledge in soft matter physics.

Granted internship : yes (700 €/month)

C'nano IdF laboratory (France only) : yes

Possibility for a thesis : yes (type of grant : CFR)