

Research Topic for the ParisTech/CSC PhD Program

Subfield: Physical Chemistry, Materials Science, Polymer Science

ParisTech School: ESPCI Paris

Title: Bio-based polymer hydrogels to control adhesion

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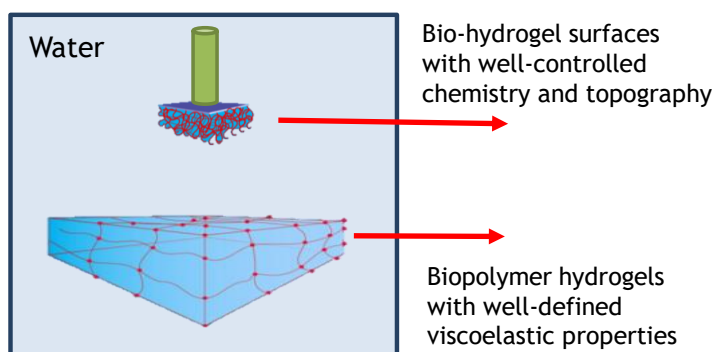
Web site: <http://www.simm.espci.fr/>

Publications: [C. Creton](#)

Short description of possible research topics for a PhD:

How does bioadhesion work? How can we control bioadhesion? The wide interest in bioadhesion research is due to its relevance for the development of new biomaterials, therapies and technological products. The objective is to go beyond synthetic model systems by using more realistic bio-polymers or bio-based polymer hydrogels. This project is interdisciplinary and bridges polymer surface chemistry with mechanics of soft materials and biomimetics.

- **Bio-based hydrogel grafted films** with a well-controlled chemistry and topography will be synthesized as biomimetic surfaces, by adapting the successful strategy that our group has developed for synthetic hydrogel films. Surfaces grafted with hydrogels of gelatins and polysaccharides such as hyaluronic acid, alginic acid and chitosan will be designed.
- **Biopolymer soft adhesives** with a well-defined deformability will be synthesized. As there is a strong coupling between interfacial and viscoelastic properties in adhesion processes, the bulk mechanical properties of adhesives have to be controlled systematically.
- **Underwater adhesion tests** are performed using a home-made probe-tack device, which simulates “real-life” conditions that may be encountered in bioadhesion or mucoadhesion. The underwater adhesion properties will be investigated by varying the viscoelastic properties of the biopolymer adhesive as well as the interfacial (chemical) interactions between the adhesive and the surfaces.



Required background of the student: Chemistry, Chemical Engineering, Materials Science

A list of 5 (max.) representative publications of the group:

Sudre, G.; Olanier, L.; Tran, Y.; Hourdet, D.; Creton, C. *Soft Matter*, **2012**, *8*, 8184-8193.

Sudre, G.; Tran, Y.; Creton, C.; Hourdet, D. *Polymer*, **2012**, *53*, 379-385.

Chollet, B.; Li, M.; Martwong, E.; Bresson, B.; Fretigny, C.; Tabeling, P.; Tran, Y. *ACS Appl. Mat. Interfaces*, **2016**, *8*, 11729-11738.

Guo, H.; Sanson, N.; Hourdet, D.; Marcellan, A. *Adv. Mater.* **2016**, *28*, 5857–5864.

Creton, C.; Ciccotti, M. *Rep. Prog. Phys.* **2016**, *79* (4), 40616.