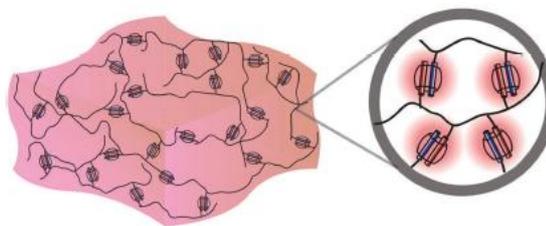


Master semester project

Proposal: Crosslinking of polymer brushes II

Description of the project:

Surface grafted polymer brushes possess outstanding non-fouling [1] and tribological [2] properties. Their properties derive from their special, via grafting density and solvent controllable conformation. This conformation can vary from mushroom (bad solvent, low grafting density) to stretched brushes (good solvent, high grafting density). Brush-mediated lubrication is a well-known phenomenon that is strongly dependent on the brush-conformation and can therefore be influenced by tuning of the cross-link architecture. Several ways to induce intermolecular cross-links in polymer brushes („brush-gels“) have been reported in literature, mainly of covalent nature. Irreversible crosslinking of poly(2-hydroxyethyl methacrylate) (PHEMA) with ethylene glycol-containing bifunctional monomers and the influence of cross-links on the non-fouling properties of brush hydrogels have been reported [3]. Cross-links can also be induced by post-polymerization modifications, as reported for self-crosslinking poly (glycidyl methacrylate) (PGMA) brushes [4]. Covalent cross-links are irreversible while non-covalent cross-links renders gel-brushes reversible and potentially stimuli-responsive. One way to induce reversible cross-links are supramolecular bonds like host-guest interactions. An example for hosts that undergo complex formation with hydrophobic guests in water is β -cyclodextrine. UV- as well as electrochemically switchable host-guest complexes are reported in literature. However, none of them has been used for the formation of stimuli-responsive brush-gels. This project deals with the reversible cross-linking of polymer-brushes via host-guest interactions. Brushes will be prepared via Surface-initiated atom transfer polymerization (Si-ATRP). The monomers will be synthesized in advance and characterized via NMR spectroscopy. Characterization of the resulting brushes and brush-gels via ellipsometry, x-ray photoelectron spectroscopy (XPS), Fourier transform infrared spectroscopy (FTIR) and water contact angle (WCA) measurements will be performed as well as tribological experiments.



supramolecular host-guest complex crosslinked polymer chains

References:

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2. Mocny P, Klok H-A. Tribology of Surface-grafted Polymer Brushes. *Molecular Systems Design & Engineering*. 2016;1(2):141-54.
3. Dehghani E S, Spencer N D, Ramakrishna S N, and Benetti E M. Crosslinking Polymer Brushes with Ethylene Glycol-Containing Segments: Influence on Physicochemical and Antifouling Properties. *Langmuir*. 2016; 32(40):10317-10327.
4. Edmondson S, Huck W T S. Quasi-2D Polymer Objects from Patterned, Crosslinked Polymer Brushes. *Adv. Mater.* 2004;16(5):1327-1331.

Contact: Friederike Metze – friederike.metze@epfl.ch