M.Sc.Thesis (15.02.23):

Insertion of a dynamic, self-assembling capsule into artificial polymer membranes on solid-support for the development of smart surfaces

Abstract/Description:

Artificial biomimicking membranes based on amphiphilic block-copolymers have many advantages over lipid membranes, such as higher mechanical stability, physical and chemical tunability related to thickness or sensitivity to certain external triggers, such as pH or temperature. Similar to their biological role models, they are able to integrate biomolecules due to their flexible hydrophobic blocks such as pore proteins, ion channels and membrane-bound enzymes. When immobilized on a solid-support, these membranes can be used as a model to study their physico-chemical properties as well as their interaction with any other moiety, for example the ability to bind different small molecules.

Besides biomacromolecules, there are also artificial macromolecules which are interesting to insert into polymer membranes. For example, resorcinarenes (Rs) have the ability to assemble in into hexameric capsules bearing a cavity with a defined size, able to encapsulate specifically cationic and polyhydroxylated guest molecules. Membranes equipped with functional Rs capsules, able to dynamically assemble and disassemble, could be used for different applications, such as the development of smart surfaces for (bio)sensing, heavy metal detection and removal from aqueous solutions, or storage and release of desired guest molecules. The difficulty here is to provide strictly apolar conditions, necessary for capsule assembly.

Goal

In this project, you will optimise the formation of hybrid membranes consisting of block-copolymers and Rs monomers and screen different Rs and polymers for their ability to form stable membranes containing functional capsules on a solid support. You will learn different deposition techniques (solvent-assisted deposition, Langmuir monolayer transfer) as well as membrane characterisation methods (surface coverage, ellipsometry, contact angle, atomic force microscopy). Furthermore, you will learn a state-of-the-art surface-sensitive technique (Quartz-crystal microbalance with dissipation, QCM-D) in order to test the guest molecule uptake and to monitor of the visco-elastic properties of the membrane.

Requirements

You are a highly-motivated M.Sc. student in chemistry, nanosciences, material sciences, pharmaceutical sciences, biochemistry, biotechnology or any related field. Ideally, you have knowledge in colloidal chemistry and nanosciences or are interested in diving into the field. You should be proficient in English.

Starting date as soon as possible.

Contact details

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