Pressure-Induced Coil to Globule Transition in Poly-Sulfobetaine Polymer Systems: Towards Tailored Antifouling Coatings

This 3-year PhD project aims to understand the coil-to-globule transition in poly-sulfobetaine polymer systems through extensive high-pressure experiments. The pressure and temperature responses of polymers with an upper critical solution temperature (UCST) have remained largely unexplored, despite the expected strong pressure response due to the high excess volumes associated with the transition. A strong pressure response would make these UCST polymers promising candidates for tunable materials and surface coatings, particularly for antifouling applications or pressure-based cleaning procedures.

In this research project, we aim for a comprehensive thermodynamic and structural characterization of the pressure and temperature response of UCST-type poly-sulfobetaine polymers in solution and as polymer brushes grafted to solid surfaces. To achieve this, we will combine x-ray and neutron scattering techniques with complementary experimental methods, atomistic molecular dynamics (MD) simulations, and thermodynamic modeling. Additionally, we will investigate the influence of pressure and temperature on the antifouling properties of the polymer brushes by quantifying surface adsorption of proteins and their triggered desorption.

The total duration of the project is 3 years, with 1 year financed by **TU Darmstadt (Germany)** and 2 years by the Institut Laue-Langevin **(ILL, Grenoble, France)**. The doctoral researcher will begin the project (2 years) at the ILL, focusing on the thermodynamic and structural characterization of semi-dilute polymer solutions and polymer brushes, utilizing the PSCM laboratories' equipment as well as the neutron reflectometers and small-angle scattering machines at the ILL. The final year of the project will be conducted in the group of Emanuel Schneck at TU Darmstadt, where the doctoral student will investigate the antifouling properties of the grafted polymers with x-ray reflectometry and their response to short pressure pulses for controlled cleaning protocols. Depending on external funding, the periods spent at the ILL and TU Darmstadt might change from 2 years and 1 year to 1.5 years each.

We are seeking a highly motivated candidate with an M.Sc. in Physics, Chemistry, Material Science, or Chemical Engineering. Aptitude for data analysis is an asset for this position. We offer a collegial, international, and interdisciplinary working environment. The ILL is the most intense neutron source in the world, and the student will work with cutting-edge large-scale instruments on a highly international and multidisciplinary campus located in the heart of the French Alps.

How to Apply: Please send an email to Dr. Leonardo Chiappisi (chiappisil@ill.fr) and Prof. Dr. Emanuel Schneck (emanuel.schneck@pkm.tu-darmstadt.de) with the subject "SCM-2024-28-YourName". Please attach a single PDF including a brief motivation letter, CV, Bachelor certificate, and Master certificate (if available), a short abstract of your Master thesis, and at least one contact person for a reference. This project is open for applications until 30th June 2024 and will be closed after this date if a suitable candidate is found.

For additional details about the specific conditions for the PhD and the application procedure, please consult the following link: ILL PhD Recruitment.