PH.D. & INTERNSHIP POSITIONS IN TOULOUSE

Micro-fluidic osmotic compression for the measurement of properties of colloidal dispersions.

Mixes of colloidal particles (nanoparticles, proteins, crystals…) suspended in a fluid are used in numerous applications in the fields of cosmetics, smart materials, food science, construction, health, paint… They are tagged "complex fluids" since their thermodynamic and transport properties vary (diffusion coefficient, viscosity, osmotic pressure), in particular with the local particle concentration.

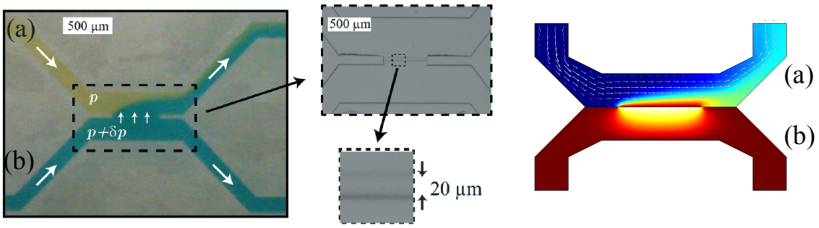

Figure 1 : micro-fluidic chip (left) and simulation of on-chip-compression (right).

The goal of this project is to develop and validate **microfluidic systems** (see Figure) to measure these properties in a very short time compared to classical techniques. We will introduce a drop of complex fluid in the chip through channel (b) so that it can be brought in contact with a filtration membrane synthesized directly in the chip (center of the picture). We will then remove the liquid phase of the drop progressively through the membrane by pumping it with a so-called stressing fluid circulating in channel (a). **The observation of the size and dynamics of the drop, coupled to the use of suitable models, will enable to measure the desired transport properties.**

The first chips have already been developed by the laboratory LOF in Bordeaux, one partner of this project, to demonstrate the feasibility of the in-situ membrane synthesis and its good mechanical stability. The project has **three main objectives**: (i) **To optimize the chip design** in terms of hydrodynamics and fluid composition tuning; (ii) **to validate osmotic pressure values** obtained with the chip by comparison with other methods we master and on well-known model dispersions (silica nanoparticles, polymers, and proteins); (iii) **to develop analytical and/or numerical models** permitting the extraction of transport properties from the transient dynamics of the drop during compression.

Context: the Ph.D. and internship positions are part of the OsmoChip ANR project gathering the **Solvay** company, the **Laboratory of the Future** (LOF Bordeaux, joint CNRS-Solvay lab), and the **Laboratoire de Génie Chimique** (LGC Toulouse, joint University-CNRS lab), with a total of 10 permanent researchers, engineers and technicians, 2 Ph.D.s and one post-doc. The person recruited will work at LGC Toulouse in the "Interfaces and Divided Media Department" including about 30 permanent staff and as many Ph.D.s and post-docs. Starting date: January 2019 for the internship, October 2019 for the Ph.D. Duration: 3 years. Ph.D. net salary: ~1500 €/month. Advising by Yannick Hallez, Patrice Bacchin and Martine Meireles.

Candidate profile: skills in **hydrodynamics, physics, physico-chemistry, and/or numerical methods** will be appreciated (degrees in **fluid mechanics, chemical engineering, physics**…). The person recruited will lead microfluidic **experiments**, use state-of-the-art characterization techniques (confocal microscopy, scattering…) and setup multiphysics **simulations**. She/He will have to interact with all the participants of the OsmoChip project to benefit from this stimulating context and to push her/his project onward.

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