Post-doctoral fellow (24 months)

Photo-patterning of nano-porous hydrogel-based membranes for microfluidic osmotic compression of complex fluids

The principle of *osmotic compression* is shown in Fig 1(a). A dilute formulation contained within a milliliter dialysis bag is immerged within a reservoir containing a stressing solution (generally polymers). The porosity of the dialysis membrane retains large colloidal species (10-1000 nm), but still allows fluxes of solvent and molecular solutes. The osmotic pressure difference across the membrane then drives a flow to equilibrate chemical potentials of the molecular species. Besides providing an easy way to concentrate dilute formulations without tedious hand-made mixing, this technique also leads to estimates of the equation of state of the complex fluid, i.e. the relation between the osmotic pressure π and composition.

However, despite its relevance for industrial R&D, osmotic stress is rarely used as *very long* equilibration times are often required owing to the large volumes of the dialysis bags ($\approx$ 1-10 mL) and the weak mass transfer. The present project aims to develop microfluidic chips, integrating ***nano-porous hydrogel-based membranes*** [1], for mimicking osmotic compression but at the nanoliter scale, Fig. 1(b). We expect unprecedented improvements in the time scale of measurements owing to the large surface-to-volume ratios. Such microfluidic tools would also make possible the use of *in situ* measurements to probe the microstructure of the complex fluid during its compression. During the project, these tools will be used in collaboration with ***Solvay*** for evaluating the stability of industrial formulations. The ultimate goal of the project is to demonstrate that such microfluidic tools may open the way to rapid screening of formulations and of equations of states, thus decreasing possibly current R&D costs and development times.

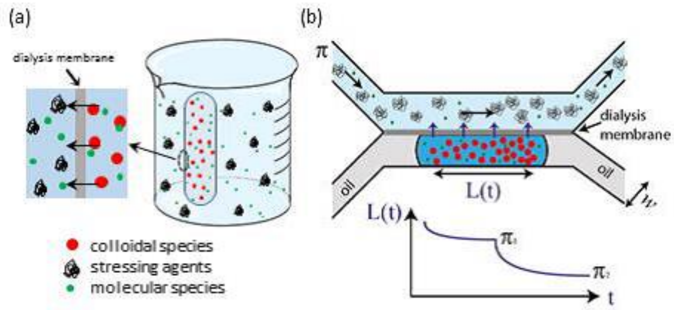

Fig 1. (a) macroscopic vs. (b) microfluidic osmotic compression in the case of a colloidal dispersion. The typical transverse dimension of the channel is *w*<100 µm.

Keywords
microfluidics, soft matter, membranes and dialysis

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Required qualifications
Candidates must have a PhD. A specialty/expertise in the field of microfluidics, soft matter and/or chemical engineering will be appreciated. Expected starting date: dec-2018/jan-2019

[1] DECOCK, SCHLENK, SALMON, LAB CHIP 18, 1075 (2018)