Imaging flowing Soft Matter *in situ*

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Most systems in biology or in soft matter are extremely sensitive to the sample environment. This is why they can behave very differently under external physical or mechanical constraints. We are interested in understanding the behavior of such systems under flow, tensile solicitation, and gravity.

As confocal scanning microscopy is a powerful technique for 3D imaging and can be used to measure the spatial organization of micrometric objects with excellent resolution we have developed special environmental sample holders, coupling observation and solicitation.

The first device is used for studying biofilms, and it combines a microfluidic chamber and uniaxial tensile device, see Figure 1a for a photograph and a scheme. The aim is to understand how bacteria can form a biofilm when subjected to a liquid flow and when the colonized surface is under cyclic mechanical solicitation.

With the second device, where the laser beam is redirected and focused horizontally on the sample, we can study the effect of gravity on the emulsions and expect to see an influence of the degree of confinement on the creaming or sedimentation behavior.

We describe thus two holders, which allow the imaging of the formation of a bacterial biofilm under external constraints and the creaming of emulsion droplets in confining vertical capillaries. These examples can give important intakes in understanding the behavior of the real systems under flow or stress.

Confocal scanning microscopy is since this development a powerful technic for imaging living cells or biomaterials, thanks to the control of the depth of filed, and the rapid 3D imaging.

We show here 2 home-made devices.

The first device is used for studying biofilms, and it combined microfluidic chamber and load machine. The aim is to understand how bacteria can form a biofilm when subjected to a liquid flow and when the colonized surface is under cyclic mechanical solicitation. We will describe the device (fig. plans SW, and image) and the experimental constraints.

The second device is a deported system allowing a 3D vertical imaging. Using a periscope and a 3D controlled home-made device, we can study the effect of gravity on the emulsions. Indeed, emulsions form micro channels, in which oil droplets are confined. The device will allow studying the confinement of the droplet, what control the draining and/or the jamming.