Institut für Strömungslehre und Wärmeübertragung

Bachelor / Master Thesis

Folds in strongly compressed particle raft

The interest for microparticles at fluid interfaces has considerably increased in the last decades. Once adsorbed at interfaces, such particles provide strong stabilization and have the advantage to be more environmental friendly than classical surfactants that cannot be easily recovered by simple filtration. Thus, they have been used to produce new materials such as super stable foams or bijels but also to reversibly encapsulate fluids in the form of coated droplets. The latters can be used to collect, transport and deliver some actives or pollutants. Yet, the mechanical properties of these complex multiphase assemblies remain poorly understood, which currently limits their usage to academic niches.

One key aspect is that these assemblies, while elastic under moderate constraints, develop plasticity when folded (see figure 1), i.e. when subjected to strong compression. Yet, to date, neither the origin of this plasticity, nor the parameters fixing the fold geometry are identified. The goal of this project is to gain knowledge on these aspects by systematically carrying out advanced experiments. The experiments should monitor - for various parameters - the geometry of the folds (using a laser sheet) as a function of the applied stress (using a self-made through equipped with calibrated sensing rubbers, see, figure 2). The parameters to be varied include: the compression rate, the initial raft aspect ratio, the through wall materials (friction), the type and size of used particles and the raft history. The first task of this project is to identify which of these parameters are relevant, while in a second step, the goal will be to precisely study the effects of the parameters previously identified as relevant.

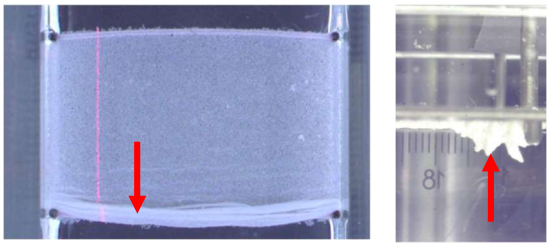

Figure 1: left / right: top / side view of a compressed raft. The folds are indicated by red arrows.

From Bachelor thesis of P- Schoefmann (2023)

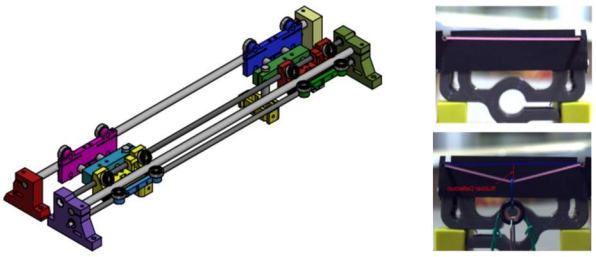

Figure 2: Left: rig used to uniformly compress rafts confined in a through. Right: rubber sensors measuring the stress. Top / bottom: without / with load during calibration.

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Tasks

- Preparing particle rafts and conducting experiments
- Analyzing experimental data (image analysis based on existing routines)
- Interpret the results and write the corresponding scientific documentation.

We offer

- A scientific supervision of high quality
- An international and dynamic work atmosphere
- Access to all the required facilities of the Institute

The master project will be accomplished at the Institute of Fluid Mechanics and Heat Transfer (Institut für Strömungslehre und Wärmeübertragung). The project can start any time. If interested, please contact Dr. Carole Planchette, Tel. 0316 873-7357, Email carole.planchette@tugraz.at