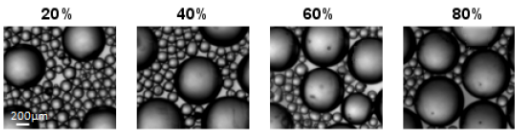
Institut für Strömungslehre und Wärmeübertragung

Diplomarbeit / Master Thesis

Effects of particles buoyancy on raft properties

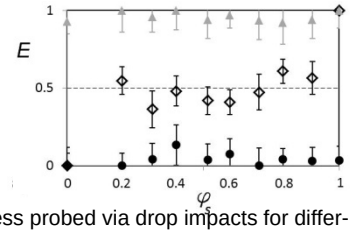
The interest for microparticles at fluid interfaces has considerably increased in the last decades. Once adsorbed at interfaces, they allow for their stabilization resulting for example in Pickering emulsions, super stable foams or bijels. These complex multiphase assemblies open routes to elaborate and manufacture new materials or membranes. For example, it has been proposed to use such particles to reversibly encapsulate fluids in the form of coated droplets which can thus be used to collect, transport and deliver some actives or pollutants.

Despite the huge applicability of such interfaces, the understanding of how the microscopic particle properties give rise to the interface mechanical macroscopic behaviors remains very poor. While the correlation seems to originate particle-particle contacts enabling force chain network to form, very little is known about. Based on results obtained with bidisperse particle mixtures [1-2], it has been proposed that the force chain network is strongly affected by the type of particle-particle contact at stake. In this work, we propose to test this idea using particles of different buoyancy. The purpose of this project is to transpose the method used on bidisperse particle mixtures to assemblies of particles having different buoyancy.



Top views (photographs) of particle rafts made of mixtures of hydrophobic microbeads. Two particle sizes are considered and the ratio of small/large particles is varied.

From [1], Physical Review E (2016), Petit et al



Left: drop on a particle raft.

Right: particle raft robustness probed via drop impacts for different raft composition (φs relative amount of small particles)

From [2], Soft Matter (2018), Planchette et al

Tasks

- Mixing hydrophobic hollow and full glass beads. Mixture characterization (particle size distribution, contact angle, composition)
- Characterization of the raft properties using existing set-ups: (i) uniaxial quasi-static compression, (ii) decompression visualized via high speed imaging
- Data treatment (image analysis)
- Data analysis and comparison with existing data obtained with full glass beads.
- Writing 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