

6-months Internship for Masters-Project

Exploring foam-instabilities by time and space-resolved dynamic light scattering

Project proposed by Deniz Gunes (Nestlé Research Center, Lausanne) / Véronique Trappe (University of Fribourg, Department of Physics, Fribourg).

Start date : between May 1st and July 1st.

Keywords: foams, coalescence, Ostwald ripening, drainage, particles at interfaces, diffusing-wave spectroscopy, rheology

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There is an opening for an internship on the level of a master-student available July 2011 or earlier.

The project in the frame of a collaboration between the Physics department of the University of Fribourg (2/3 of the time) and the Nestlé Research Center (1/3 of the time).

The goal is to develop model systems that will enable us to control the relative importance of drainage, coalescence and Ostwald ripening in a coarsening foam [1]. These systems will then be used as benchmark-systems to test the hallmarks of the different instabilities in diffusing wave spectroscopy (DWS) [2], where will use CCD-based correlation schemes to resolve bubble reconfigurations with spatial and temporal resolution [3-5]. Some chosen examples of foams will be investigated to explore specific parameters that govern the long-term stability of foams typically used in food-stuff.

The development of model systems will be carried out at the Nestlé Research Center under the supervision of Deniz Gunes, while the core of the investigations using space and time-resolved dynamic light scattering to characterize these systems will be carried out at the University of Fribourg under the supervision of Véronique Trappe.

The ideal candidate will have a background in Soft Matter Sciences and have some experience with dynamic light scattering and rheology. General skills in experimental physics, taste for independent work and critical thinking are required.

PROPOSED PROGRAM OF INTERNSHIP

1) Preliminary work

- a) Acquiring the theoretical background about foam physics and physical chemistry: hydrodynamics of drainage, coalescence, Ostwald ripening, emulsifiers, interfacial rheology, transport phenomena.
- b) Acquiring the basics of advanced dynamic light scattering methods: diffusing-wave spectroscopy, space and time resolved methods.

2) Main work

- a) Development of a methodology to produce model foams and to transfer them into cells that can be implemented in a DWS-set up.
- b) Study the DWS signature of instabilities using the selected model systems.
- c) Comparison with microscopy observation in thin cells.
- d) Work on the understanding of the main destabilization phenomena
- e) Development of a system for the specific characterization of coalescence by time and space resolved DWS.

References

1. Weaire D, Hutzler S: *The Physics of Foams*. Oxford: Clarendon Press; 1999.
2. Weitz DA, Pine DJ: **Diffusing-wave spectroscopy**. In *Dynamic Light Scattering: The Methods and Some Applications*. Edited by Brown W: Clarendon Press; 1993:652-720.
3. Cipelletti L, Bissig H, Trappe V, Ballesta P, Mazoyer S: **Time Resolved Correlation: a new tool for studying temporally heterogeneous dynamics**. *J. Phys.: Condens. Matter* 2003, **15**:257-262.
4. Duri A, Bissig H, Trappe V, Cipelletti L: **Time Resolved Correlation measurements of temporally heterogeneous dynamics**. *Phys. Rev. E* 2005, **72**:051401.

5. Sessoms DA, Bissig H, Duri A, Cipelletti L, Trappe V: **Unexpected spatial distribution of bubble rearrangements in coarsening foams**. *Soft Matter* 2010, **6**:3030-3037.

Notes to groups and methods:

The Soft Matter & Photonic group at the Physics Department of the University of Fribourg, is specialized in the characterization of soft matter systems using optical tools and more specifically the team of Véronique Trappe developed the tools to characterize dynamical heterogeneities in compressed systems such as foams. The lab is equipped with a variety of tools, including DWS, wide angle static and dynamic light scattering, confocal microscopy and rheometry.

The NRC Food Science and Technology Department possesses a very extended and high-quality experimental facility in terms of analytical and R&D investigations. It includes e.g. diverse soft matter characterization tools (Light Scattering, DWS, Fast imaging, Tomography, physico-chemical characterization tools, advanced tensiometry, advanced interfacial and bulk rheometry, particle), optical and electronic microscopy tools, as well as microfluidic methods allowing generating model food structures. Regarding drainage in foams, conductimetry methods are implemented in the Foamscan apparatus (Teclis).

The masters will be remunerated over a 6 months period

Applications, comprising a curriculum vitae and the address of at least one referee should be send to:

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