Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Rheological behavior of a millimetric foam films assembly: Part I Elasticity[1] ADRIEN BUSSONNIERE, ISABELLE CANTAT, Institut de Physique de Rennes — Liquid foam has been extensively used in several industrial applications for its surprising viscoelastic rheology allowing to efficiently dissipate energy. However, the origin of this behavior remains unclear due to the lack of the local constitutive laws of the liquid matrix. Here, we experimentally and theoretically investigate the dynamic of an elementary brick of foam constituted of 5 soap films. A horizontal film is connected, through two free menisci, to four peripheral films (two on each side) with controllable lengths. Deformation consists of a simultaneous stretching of peripheral films on one side and compression on the other side. Kinematic quantities (velocity and thickness) are measured during the excitation and the relaxation. Surface tension variations, induced by the deformation, result into a free menisci displacement and these two quantities have been linked allowing us to monitor local forces. We quantify the elastic constitutive law of the film by relating film extension and surface tension variation. It is shown that film exhibits a purely elastic behavior, well captured by a model based on surfactant conservation. This demonstrates that the dissipation is localized close to the menisci, and is not controlled by the interfacial viscosity of the thin films.

[1]This project has received funding from the European Research Council (ERC) under the European Unions Horizon 2020 research and innovation programme (grant agreement No 725094)

Adrien Bussonnire
Institut de Physique de Rennes

Date submitted: 24 Jul 2020 Electronic form version 1.4