

Abstract Submitted
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Rheological behavior of a millimetric foam films assembly: Part II Viscosity¹ ISABELLE CANTAT, ADRIEN BUSSONNIRE, Univ de Rennes I — A foam, made of inviscid gas and Newtonian liquid, has an effective viscosity that may reach thousand times the viscosity of the foaming solution. Liquid phase confinement is at the origin of this spectacular viscosity enhancement. However, one puzzling question remains: how, and where, is the imposed stress transmitted to the liquid phase?

Using a dedicated, home made, "thin film rheometer", we measure local velocities and tensions and show that (i) a generic geometrical frustration arises from the fact that 3 films meet at each meniscus (ii) the rate of surfactant transfer, from one film to its neighbor, is controlled by the tension difference between the two adjacent films, and determines the dissipation rate.

We develop a model based on the Stokes equation and on the surfactant diffusion/convection, and we show that Marangoni stress is strong enough to shear the films, only in a small region close to the menisci, which extension ℓ may be of the order of 100 micrometers for usual physicochemical properties. We thus predict the existence of a sheared regime, for bubble size $d < \ell$, in which the imposed shear is entirely transmitted to the thin films, and of a regime of film extension/compression, with localised film shearing, for $d > \ell$.

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