Level-set simulations of sheared 2D foams

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ABSTRACT

Liquid foams are dispersions of gas bubbles in a soapy liquid matrix. They are also yield-stress fluids, intermediate between solids and liquids, used in various applications for their large specific area, light weight, and insulating properties. In particular, their stability and rheology strongly depend on the type of surfactants used to generate them. To link these macroscopic properties to the microscopic dynamics at the bubble and surfactant scale, we investigate bubble rearrangements, called T1 events, under shear through numerical simulations. We use a two-phase flow level-set method adapted to include surfactant dynamics [1] and investigate the role of the adsorption depth, a measure of surfactant distribution between the bulk and surface, on surfactant transport (figure 1) and dissipation due to viscous and surface (Marangoni) effects.

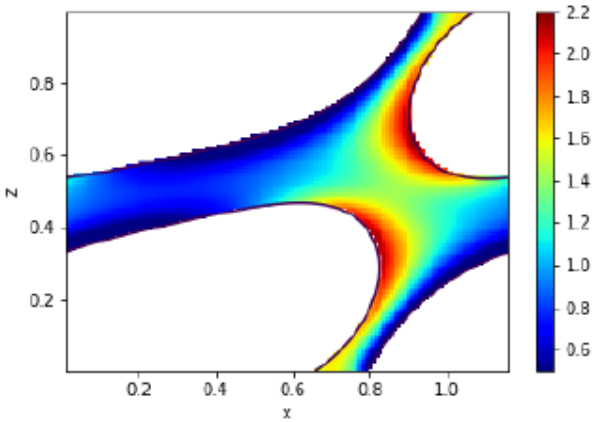

Figure 1: Normalized bulk surfactant concentration (in the liquid) during T1 event

[1] A. Titta, M. Le Merrer, F. Detcheverry, F., P.D.M. Spelt, A.-L. Biance, Level-set simulations of a 2D topological rearrangement in a bubble assembly: effects of surfactant properties. Journal of Fluid Mechanics 838, 222-247 (2018)