Controlling foam yielding using mechanical vibrations

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ABSTRACT

It is well known that mechanical vibrations alter the deformation properties of various materials. Foams are not excluded of this scenario given that they behave both like solids and liquids. In the present work we study the effect of mechanical vibrations on a foam flow. To do that, we measure the propagation of a 2D dry foam in a radial Hele-Shaw cell. The yield rate is manipulated by mechanical vibration using single frequency acoustic waves from 30 to 150 Hz and the flow speed is recorded to a video stream. To model the flow behaviour, we use a Guzman-Arrhenius type of energy landscape where the local yielding correlates with the frequency. In addition we measure the number of T1 events triggered by a 30 Hz pulse induced during 1s applied every 10 second. We show that, as the frequency increases, the plastic event rate increases reflected as an increase of the flow velocity. We create a second experimental setup with a confined geometry and an oscillating pressure to confirm our analytical model. We conclude that foams as a yield stress fluid can be modelled with a simple energy landscape model.

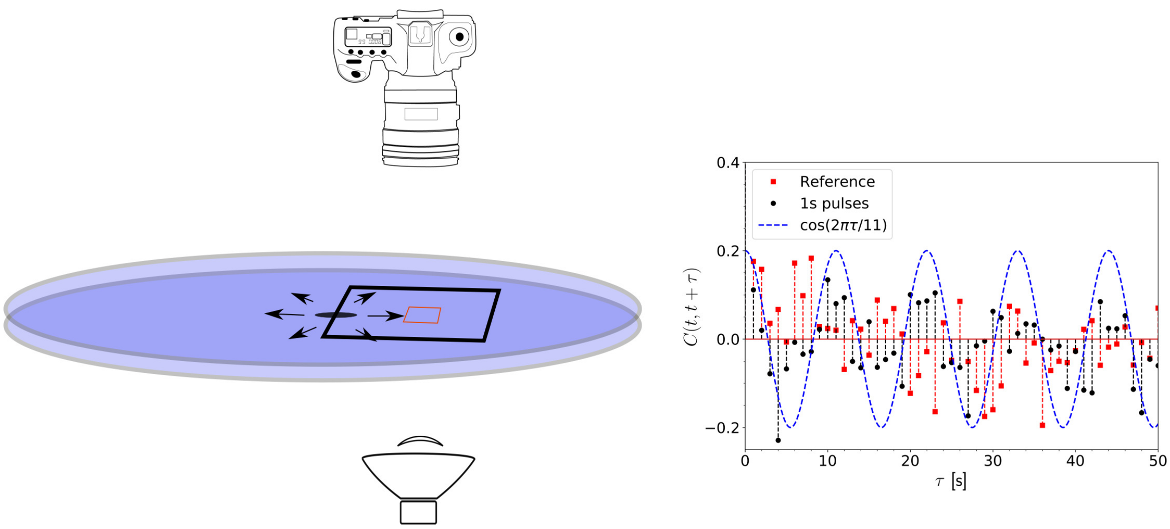

Figure 1: Using a radial Hele-Shaw cell, we record and analyse the flow velocity and T1 events in the region of interest from the delimited area when mechanical vibrations are applied. We explain successfully the correlation between applied frequency and the local yielding events.