The dynamics of a liquid foam, and its scale invariant regime

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Liquid foams consist in bubbles of gas separated by a continuous phase of liquid occupying a small fraction of the foam's volume. Although air and water do not absorb the visible light, the air-water interfaces refract it and it is impossible to image details of the bubbles structure. The solution is X-ray tomography, at high speed to be able to follow the foam evolution.

A foam coarsens because the gas slowly diffuses through the liquid films from bubbles at high pressure to those at low pressure. We investigate "dry" foams (that is, with a very small fraction of liquid): we monitor the time evolution of both individual bubble volumes and statistical distributions over the whole foam. The bubbles grow or shrink according to their number of faces, in marked contrast with isolated spherical bubbles. Lots of bubbles shrink and disappear, so that the number of bubbles decreases and the average size increases. However, after a long transient, the foam eventually reaches a regime where the shapes of bubbles are constant, as well as the distribution of their number of faces, or of their relative volumes. We characterise this so- called "scale invariant regime" and compare it with simulations.

We also study "wet" foams with a fairly large amount of water. We evidence the cross-over between the dry foam regime and the isolated round bubbles.