Energy and Environment seminar

The Coarsening of Very Wet Foams

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Abstract

Two dimensional foams that are dry, consisting of space-filling bubbles separated by thin films of negligible thickness, are far from equilibrium and evolve with time by the diffusion of gas across the films from small low-pressure bubbles into large low-pressure bubbles. This is described by von Neumann's remarkable law, $dA/dt=K(n-6)$ where A is the area of an n-sided bubble, the collective effect of which brings the foam to a self-similar scaling state where the average area grows as the square root of time. In this talk, I will point out the importance of the area-weighted side number distribution and I will review our efforts to generalize the von Neumann law to wet foams. We find that gas transport is not just across films but also happens to a surprisingly large degree across liquid-inflated Plateau borders shared by three neighboring bubbles. This gives rise to behavior that depends on bubble size and shape, which we confirm by experiment. Translating this effect to three dimensional wet foams gives insight into a puzzling observation that foams at the jamming transition coarsen with the same power-law time dependence as a froth of dilute bubbles. In particular, we predict a logarithmic correction that was not evident in early observations. And we compare with on-going experiments aboard the ISS by a joint ESA-NASA team.