Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Disorder growth in a monodisperse foam in microfluidics NICOLAS TACCOEN, LadHyX and Dept of mechanics, Ecole Polytechnique, 91128 Palaiseau, France, BENJAMIN DOLLET, Institut de Physique de Rennes, Université Rennes 1, CNRS (UMR 6251), Rennes 35042, France, CHARLES BAROUD, LadHyX and Dept of mechanics, Ecole Polytechnique, 91128 Palaiseau, France — Monodisperse foam destabilisation is a complex problem and concerns various applications. For instance, the geometric structure of a foamed gel or concrete must be preserved until the matrix sets. Here we study experimentally this problem by observing, in microfluidics , the evolution of a monolayer of ∼30'000 spherical bubbles (radius 0.1mm). We are able to individually track their positions and radii during 20h. We observe a transition from a highly ordered crystalline state (polydispersity=3%) to a completely disorder amorphous state (polydispersity=30%). This final state follows the scaling laws predicted by the classical LSW theory. To describe the transition, we define a geometric criterion that classifies the bubbles in disordered or ordered population. We observe the nucleation and growth of disorder zones, while large ordered zones remain. We show that the destabilisation of the foam is not a homogeneous process, but is the combination of two effects: (i) the quick desabilisation inside disordered zones, (ii) the growth in size of these zones, at the expense of the monodisperse ordered zones. Finally, we measure the volume variation rate of each bubble and show that while most of the gas transfer occurs in disordered zones, activity exists in ordered zones.

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Date submitted: 31 Jul 2015 Electronic form version 1.4