Abstract for Dynamics Days Crete 2006
Topic: Soft Matter

Foam pattern from a chaotic bubbling

A. Tufaile[1*], J. C. Sartorelli[2]

[1] Universidade de São Paulo, Escola de Artes, Ciências e Humanidades, Brazil
[2] Universidade de São Paulo, Instituto de Física, Brazil
[*] Electronic Address: tufaile@if.usp.br

We present an experimental investigation of the agglomeration of bubbles obtained from a nozzle bubbling in a route to chaos known as period-adding route [1, 2]. Our experiment consists of a continuous production of bubbles from a nozzle, and these bubbles create foam patterns. The bubbles can assemble in various dynamically stable arrangements with different topologies, forming different kinds of foam in a liquid mixture of water and glycerol. We observed that the bubble formation regimes influences the foam obtained from this agglomeration of bubbles. The average number of bubbles in the foam is related to bubble frequency, and a periodic bubbling can generate a periodic or irregular foam, while a chaotic bubbling only generates a irregular foam. We also observed that the process of coalescence during the bubble formation causes some shape transitions in the respective foam pattern. A direct observation of the foam reveals a relationship between the air flow rate and the size of the foam. In this way we obtained the data of the number of bubbles of many foams in each bubbling regime and the bubble mean frequency. In all cases, we can consider each bubble cluster as an outcome of a large number of independent experiments, and the time evolution is a statistical ensemble, all subject to the same evolution laws constituted by a very large number of identical systems. In some sense, the bubble number in the foam behaves like a Galton board, considering that there is a binomial distribution for the number of bubbles for each bubbling frequency.
Acknowledgments: Financial support from IMFCx-CNPq and FAPESP.

[1] V.S.M. Piassi, A. Tufaile, and J.C. Sartorelli, Chaos **14**, 477 (2004)

[2] E. Colli, V.S.M. Piassi, A. Tufaile, J.C. Sartorelli, Phys. Rev.E **70**, 066215 (2004)