EPJ E Highlight - Levitating foam liquid under the spell of magnetic fields

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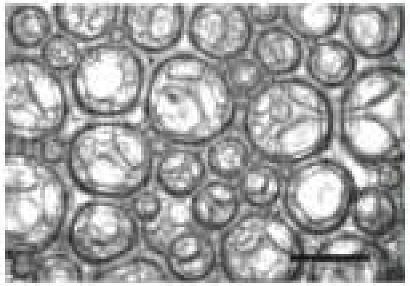

Image of the surface of the foam chamber under experimental study. © N.Isert et al.

No better solution to studying ever-draining foams than applying a strong magnetic field to keep the liquid in the foam at a standstill by levitating its water molecules

Foams fascinate, partly due to their short lifespan. Foams change as fluid drains out of their structure over time. It is precisely their ephemeral nature which has, until now, prevented scientists from experimentally probing their characteristic dynamics further. Instead, foams have often been studied theoretically. Now, Nathan Isert from the University of Konstanz, Germany and colleagues, have devised a method of keeping foams in shape using a magnet, which allows their dynamics to be investigated experimentally, as recently described in EPJ E.

To find a way around the issue of drainage, the authors used the so-called diamagnetic levitation technique. This approach exploits the fact that water—which is one of the main components of foams—has a characteristic called diamagnetism. This means that water molecules can become magnetised in the opposite direction to an applied magnetic field. Hence, a strong magnetic field can be used to levitate the water in a foam within the bore of a magnet of 18 Tesla in strength. This prevents drainage and allows a very high level of liquid to be maintained in the foam.

Isert and colleagues have used this approach to study the coarsening behaviour of foams with greatly varying liquid fractions. As a result, they experimentally verified the decades-old theoretical predictions for the growth in bubble size for dry as well as liquid foams. They found that for a liquid fraction of about 30%—which corresponds to a foam with bubbles which start to no longer touch—the gas exchange between bubbles and the corresponding growth laws changes.

Next, they will study how the local microscopic dynamics influences the foam's global dynamics. This is of particular interest when the foam transitions from a liquid to a solid form.

Coarsening dynamics of three-dimensional levitated foams: from wet to dry. N. Isert, G. Maret, and C.M. Aegerter (2013), European Physical Journal E 36: 116, DOI 10.1140/epje/i2013-13116-x

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