Perfluorocarbons efficiently suppress coalescence in foams

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Liquid foams are present in a wide range of applications, including food, beverages, medicine, cleaning or firefighting. One major challenge is the tuning of foam stability, which is determined by coarsening (gas exchange) and coalescence (film rupture). Coarsening is commonly inhibited by the osmotic effect of gases with low solubility in water, such as fluorocarbon vapors (FCs) [1]. However, we show here for the first time that these FCs also have an unexpected effect on coalescence!
Studying foams stabilized by a wide range of different surfactant types with controlled FC concentrations in the gas bubbles, we show that FCs systematically slow down coalescence, even at very low concentrations [2]. Surface tension measurements confirm the co-adsorption of FC at the gas/liquid interface leading to (i) mixed FC/surfactant layers [3] at low FC concentrations and (ii) a macroscopic FC film if the foaming gas is saturated with FC vapor. We hypothesize that this impacts the surface rheology and the interactions in the thin films separating neighboring gas bubbles. Both effects could induce a slowing down of film rupture and hence foam coalescence. To elucidate the underlying mechanisms of the improved film stabilization, investigations of isolated thin films using a Thin Film Pressure Balance are in progress.

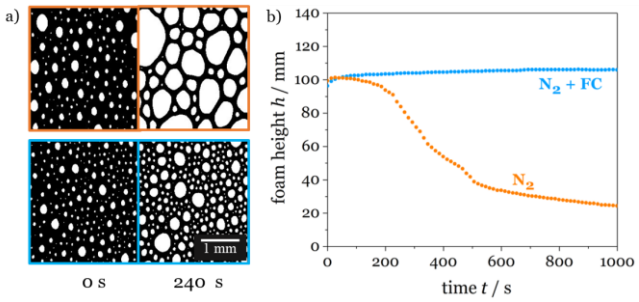

Figure 1. *Evolution of (a) bubble size and (b) foam height of $C_{12}E_6$-stabilized foams, showing that the presence of Fluorocarbon (FC) vapors (C_6F_{14}) in the foaming gas efficiently slows down coalescence.*

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References

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