

Fatty acid assemblies: from bulk to interfaces

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Fatty acids are surfactants of particular interest in the present context of green chemistry since they can be extracted from agricultural resources. Here we report on the formation of multilayer tubular structures made of ethanolamine salt of 12-hydroxy stearic acid [1-2]. The ethanolamine salt of that fatty acid exhibits two interesting but unexpected properties: (i) tubes melt into micelles at high temperatures; (ii) foams made with these tubes are outstandingly stable over months at room temperature (Figure 1.a).

In order to understand why such systems yield extremely stable foams, we used thin film pressure balance, confocal microscopy, small angle neutron scattering and neutron reflectivity in order to understand the key mechanisms at the origin of the stability.

First, we studied the behaviour of the multilayer tubes at the air/water interface by coupling neutron reflectivity and tensiometry measurements. Remarkably, our results show that the multilayer tubes are adsorbed at the interface beneath a fatty acid monolayer which produce solid layers at the interface preventing coalescence and coarsening of the foam [3]. In addition, the tubes are present in large amount in the foam liquid channels which reduce the drainage flows. Thus, these tubes solution foams easily and does not coarsen nor collapse because of an optimal arrangement of fatty acids monomers and tubes within the foam structure.

Upon heating, tubes transit to micelles at a given temperature, what yields a very fast foam destabilization. Of particular interest is that the transition of tubes into micelles inside the foam is reversible. This offers us a versatile and simple way to produce temperature tuneable foams. The foam stability can then be readily tuned to weak

foam stability by simply changing the polymorphism of the system upon heating (Figure 1.b) [4]. To our knowledge, such foams are the first that we can switch reversibly between ultrastable and unstable with the temperature.

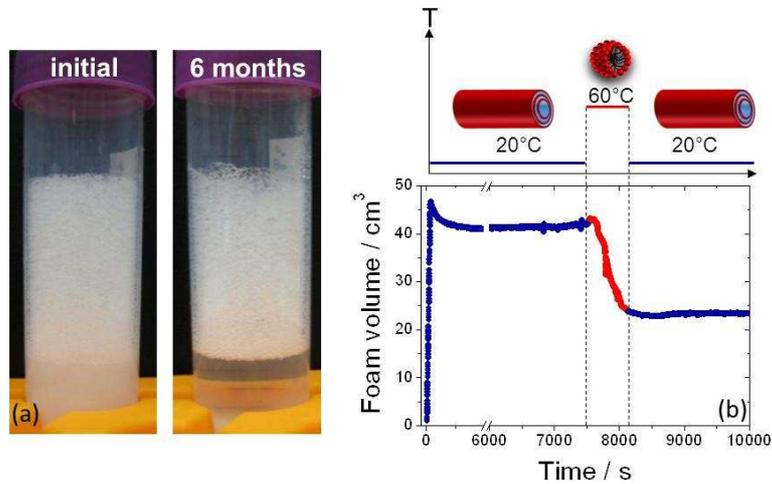


Figure 1: (a) Photos of foams taken at different times. (b) Evolution of the foam volume as a function of time and temperature.

[1] Fameau A.L., et al. *Journal of Colloid and Interface Science*, 341 (2010) 38-47.

[2] Fameau A.L., et al. *Journal of Physical Chemistry B*, 115 (2011) 9033-9039.

[3] Fameau A.L., et al. *Journal of Colloid and Interface Science*, 362 (2011) 397-405.

[4] Fameau A.L., et al. *Angewandte Chemie International Edition*, 50 (2011) 8264-8269.