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SMART FOAMS: SWITCHING REVERSIBLY BETWEEN ULTRASTABLE AND UNSTABLE FOAMS

Anne-Laure Fameau (1), Arnaud Saint-Jalmes (2), Fabrice Cousin (3), François Boué (3), Janine Emile (2), Bruno Novales (1) and Jean-Paul Douliez (1)

1. *Biopolymères Interactions Assemblages INRA Nantes, France.*
2. *Institut Physique de Rennes, Université Rennes 1, France.*
3. *Laboratoire Léon Brillouin, CEA Saclay, France.*
anne-laure.fameau@nantes.inra.fr

We have studied the foaming properties of multilayer tubular structures made of ethanolamine salt of 12-hydroxy stearic acid [Fameau, 2010]. By visual observations, we have demonstrated that these tube solutions produced foams outstandingly stable over months at room temperature (Figure 1.a). We used thin film pressure balance, small angle neutron scattering and neutron reflectivity in order to understand the key mechanisms at the origin of the stability. We have shown that those hydroxyl fatty acids quickly go to the interface but also produce solid layers preventing coalescence and coarsening. In addition, the tubes lead to large menisci surrounding the lamella and reduce the drainage flows. Thus, these tubes solution combines the advantages of both solid particles and the low molecular weight surfactants, since this system foams easily and does not coarsen nor collapse because of an optimal arrangement of 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. 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) [Fameau, 2011]. We showed how the macroscopic features as a function of the temperature depend on properties of the supramolecular assemblies in bulk. To our knowledge, such foam lifetimes obtained using low molecular weight amphiphiles are unprecedented and such foams are the first that we can switch reversibly between ultrastable and unstable in only few degrees.

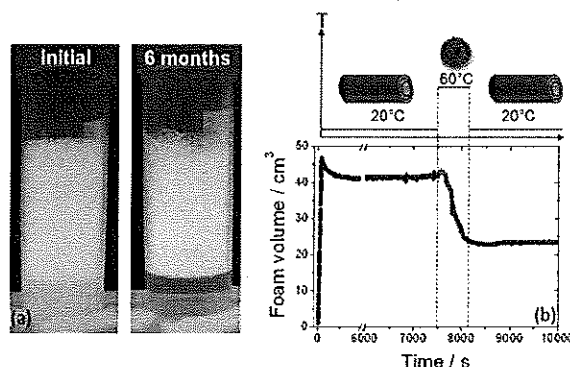


Figure 1: (a) Photos of foams taken at different times. (b) Evolution of the foam volume as a function of time and temperature.

References

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