Stabilising foams with ionic surfactants at high salinity

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Foams are made of gas bubbles in a continuous fluid matrix. The properties of the interfaces and the stability of the thin films between bubbles determines foam stability. Small molecular weight surfactants are the most commonly used stabilisers. These molecules are very sensitive to solution conditions such as temperature, pH or ionic strength. We have been working on the stability of films and foams at high salinity. The ionic strength of the solution can impact the solubility of the stabilisers, the self-assembly structures they form and their capacity to adsorb onto interfaces, and all this will change how their capacity to stabilise foam. This is important because of the natural and industrial importance of salt water, whether in oceans, our bodies, or in textile treatment.

We have worked with an anionic surfactant sodium dodecyl sulphate in salt concentrations with mainly NaCl or KCl in conditions where it precipitates into crystals. These crystals form preferably at the gas liquid interfaces, where some are shown in Figure 1 right. They are also capable of stabilising foams, as they form during foam generation to make crystal covered bubbles, as seen in Figure 1 left. Recently we have been working on foams and foam films with a cationic surfactant tetradecyltrimethylammonium bromide looking at the impact of the presence of NaCl in solution on film and foam stability. We show that while the impact of salt on the stability of single films is positive its presence decreases the stability of foam. This is due to a fine interplay between changes in molecular interactions and the dynamics of making foam.

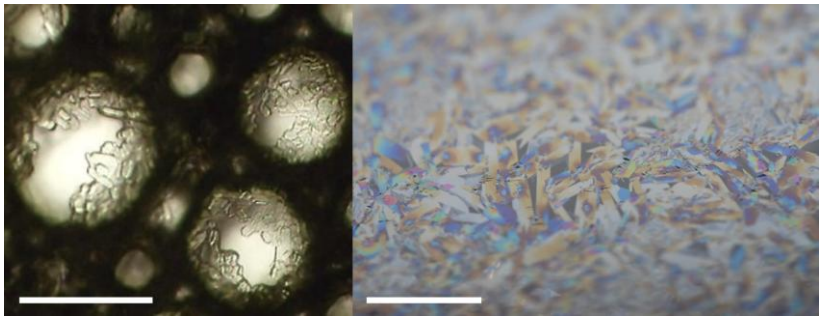

Figure 1 Bubbles with surfactant crystals on the left and crystals at a free gas-liquid interface. Scale bar is 500 µm.

[1] A Kharlamova, F Boulogne, P Fontaine, S Rouzière, A Hemmerle, M Goldmann, A Salonen, Langmuir, 2024, 40, 84−90, (2024).

[2] L. Zhang, A. Mikhailovskaya, P. Yazhgur, F. Muller, F. Cousin, D. Langevin, N. Wang, A. Salonen, Angwewandte Chemie Int. Ed. **54,** 9633-6 (2015).