Foam and Emulsion Stability. Ostwald ripening and coalescence

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Foams and emulsions are stabilized by various types of surface-active agents, surfactants, polymers, proteins or particles. Despite its practical importance, foam and emulsion stability is not yet fully understood. This stability can be frequently related to the surface compression elastic modulus E that characterizes surface tension gradients (Marangoni forces).

We will first consider the destabilization caused by Ostwald ripening, comparing surfactants and proteins stabilized foams. The role of the modulus E will be discussed. Foam experiments are being performed in microgravity conditions in the International Space Station, their principle will be presented.

We will then consider the destabilization caused by coalescence, process by which bubbles or drops fuse when the liquid films formed between them are thin enough. Experiments with mixed solutions of surfactants and polyelectrolytes will be presented. We will show that when the surface layers are solid-like, the films can be much less stable than when the layers are viscoelastic. The effect of applied pressure on stable emulsions will be discussed in link with film disjoining pressure. Experiments on surfactant stabilized 2D foams will be shown, proving that the important control parameter is the bubble size. The role of surface rheology will be finally briefly discussed.