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Stable oil-laden foams: Formation and Evolution

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Abstract

The interaction between oil and foam has been the subject of various studies. Indeed, oil can be an efficient defoaming agent, which can be highly valuable in various industrial applications where undesired foaming may occur, as seen in jet-dyeing processes or waste water treatment plant. However, oil and foam can also constructively interact as observed in detergency, fire-fighting, food and petroleum industries, where oil can be in the foam structure or put into contact with the foam without observing a catastrophic break-up of the foam. Under specific physico-chemistry conditions, the oil phase can even be trapped inside the aqueous network of the foam, thus providing interesting complex materials made of three different fluid phases that we name oil-laden foam (OLF). In this review, we focus on such systems, with a special emphasis on dry OLF, i.e. with a total liquid volume fraction, ε smaller than 5%.

We first try to clarify the physical and chemical conditions for these systems to appear, we review the different techniques of the literature to obtain them. Then we discuss their structure and identify two different OLF morphologies, named foamed emulsion, in which small oil globules are comprised within the network of the aqueous foam and biliquid foams, where the oil also comprised in the aqueous foam network is continuous at the scale of several bubbles. Last, we review the state of the art of their evolution in particular concerning topological changes, coalescence, coarsening and drainage.