

Stability and Dynamics of Aqueous Foams in Salty Solutions (MSc Seminar)

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ABSTRACT: One of the challenges in the extraction of oil from a deep sea below the sea floor lies in the identification of an appropriate fluid to displace a existing oil in the reservoir well. Due to the viscoelastic property of aqueous foams, foams have been considered as a potential injection fluid to combat the viscous fingering effect with the oil. Therefore, a deeper understanding of foam stability at the salinity level equivalent to ocean brine is important for oil recovery applications. In our work, we aim to experimentally uncover mechanisms for bulk scale and bubble scale dynamics of 3 dimensional foams at a surface at different salinities. We use synthetic ocean brine at different concentrations and a non-ionic surfactant much above its critical micelle concentration value to produce foams. In these systems, we simultaneously measure a macroscopic property, the mean foam height, and a microscopic property, the mean bubble area, using a novel imaging technique that can simultaneously probe macroscopic and surface bubble features of a foam.

At the bulk scale, the foam height is observed to be less affected by the presence of low to high salinity levels of ocean brine. This observation changes dramatically for the reservoir brine, which shows a much lower foam height and more stable at long times. The bubble scale imaging reveals that the mean bubble area has a much slower mean bubble growth rate than the rest of the salinities. All of our bubble scale dynamics data show that mean bubble area increases linearly with time; this is consistent with von Neumann-Mullins scaling state over all times. We observe an unexpected effect of a mixture of electrolytes on non-ionic surfactant stabilized foams, and we show their brine concentration dependence of foam stability at various length and time scales.

ALL ARE WELCOME!