Stabilization of CO_2-in-brine foams with amine oxide surfactants

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ABSTRACT

One of the great challenges for using CO_2-foams in enhanced oil recovery is the selection of a surfactant able to stabilize the gas/liquid dispersion in conditions of high salinity. While anionic surfactants are known to be efficient foamers, they exhibit a large adsorption on carbonates, which are the typical rocks in Brazilian Pre-Salt reservoirs. In the present work, we studied the use of two amine oxide surfactants for foaming formulations using CO_2 as gas phase and desulfated seawater (DSW) as aqueous solution. We evaluated the effect of the chain length on the foam stability, using dodecyldimethylamine oxide (C_{12}DAO) and tetradecyldimethylamine oxide (C_{14}DAO) at different surfactant concentrations. While at 0.1wt% the foam stability was very similar in both systems, at a surfactant concentration of 1wt% the CO_2-foam half-life using C_{14}DAO was twice that when using C_{12}DAO (Fig. 1). The mean bubble area (MBA) of C_{14}DAO foam after 300 s was 14 times smaller than in C_{12}DAO foam, which indicated that drainage and coarsening are retarded in this system. Foam stability results were directly related to the enhanced viscosity of C_{14}DAO solution (60x higher than C_{12}DAO), and can be explained by the formation of elongated micelles in the presence of salt, mediated by hydrogen bonding [1,2].

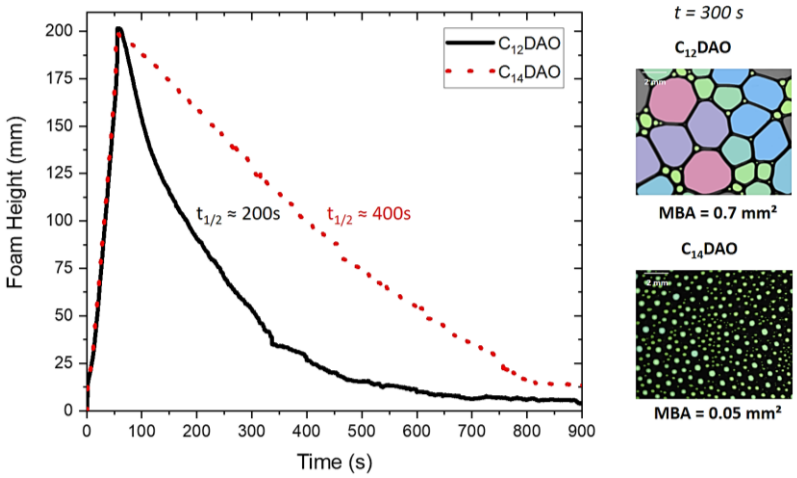

Figure 1: Foam characterization of 1.0 wt% C_{12}DAO or C_{14}DAO solution in DSW at 25°C.

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[2] C. Stubenrauch, M. Hamann, N. Preisig, V. Chauhan and R. Bordes. Adv. Colloid Interface Sci. 247:435-447, 2017.