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IMPACT OF SURFACTANT DEPLETION ON FOAM IN POROUS MEDIA

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Foam can be applied as an Enhanced Oil Recovery (EOR) process. Foam coarsens above a certain "transition gas fractional flow" in porous media. Experimental data show that for a specific porous medium, the transition gas fractional flow rises rapidly with surfactant concentration at low concentrations and approaches a constant value at high concentrations. However, there isn't a complete theory for the relationship between surfactant concentration and the gas fractional flow above which foam coarsens in a specific porous medium. The aim of this study is to investigate the relationship between the surfactant concentration, the foam-bubble radius, and the transition gas fractional flow. In this research we analysed experimental data from literature on foam properties in porous media. The analysed foams were stabilized with the same anionic surfactant (AOS), at various surfactant concentrations and in different porous media.

We test the hypothesis that these results can be explained by surfactant depletion from the solution to the gas-water interface. Results suggest that the experimental transition gas fractional flow approaches the gas fractional flow for which the gas-water interfacial area is equal to the surface area that could be covered by the surfactant molecules in the injectant.

The results imply that there is a relationship between the three parameters, 1) surfactant concentration, 2) the average foam bubble size and 3) transition gas fractional flow. Furthermore, this model predicts that above the transition gas fractional flow value water-saturation increases with gas fractional flow, in line with experimental data.