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Effects of nanoparticles on foam stability

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Foams demonstrate great potential for displacing fluids in porous media which is applicable to a variety of subsurface operations such as soil remediation and the enhanced oil recovery [1-4]. The application of foam in these processes is due to the unique ability of foam to reduce gas mobility by increasing its effective viscosity and to divert gas to un-swept low permeability zones in porous media. The success of foam as a displacing fluid depends on its stability [4-6]. Stability of foam is influenced by three principal mechanisms of (1) liquid drainage (2) coarsening and (3) the effect of oil. To date, several studies have investigated the positive effect of nanoparticles on foam stability. Despite many advances in understanding of the effect of nanoparticles on foam stability, fundamental understanding of how nanoparticles influence the above mentioned mechanisms is still unclear. In the present work, we have conducted a comprehensive series of experiments to study the effect of nanoparticle type and concentration on foam coarsening and liquid drainage respectively. Our results revealed the optimum concentration of nanoparticle to stabilize foam in A 2D Hele-Shaw cell is different from A 3D bulk-scale column and is higher for the former one. Our finding suggests that liquid drainage coupled with A high concentration of nanoparticles induces an adverse effect on foam stability. The effective contribution of nanoparticles on foam stability might be attributed to the adsorption and accumulation of nanoparticles at the gas-liquid interface of foam bubbles and Plateau borders. Additional experiments will be conducted using a zeta potential and mastersizer to investigate the distribution of nanoparticles in the liquid phase and to analyse its impact on foam stability. The findings of this study will extend our physical understanding of the effect of nanoparticle on foam stability.