Effect of Foam on Liquid Phase Mobility in Porous Media

We investigate the validity of the assumption that foam in porous media reduces the mobility of gas phase only and does not impact the liquid-phase mobility. The foam is generated by simultaneous injection of nitrogen gas and a surfactant solution into sandstone cores and its strength is varied by changing surfactant type and concentration. We find, indeed, that the effect of foam on liquid-phase mobility is not pronounced and can be ignored. Our new experimental results and analyses resolve apparent discrepancies in the literature. Previously, some researchers erroneously applied relative permeability relationships measured at small to moderate capillary numbers to foam floods at large capillary number. Our results indicate that the water relative permeability in the absence of surfactant should be measured with the capillary pressure ranging up to values reached during the foam floods. This requires conducting a steady-state gas/water core flood with capillary numbers similar to that of foam floods or measuring the water relative-permeability curve using a centrifuge.

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