Contribution ID: **394** Type: **Oral Presentation**

Developed emulsification in porous media flow

Friday, 4 June 2021 14:15 (15 minutes)

With the use of surfactants, the interfacial tension between oil and water can be lowered to a degree that solubilisation of oil by injection water leads to a near-miscible displacement. However, the resulting emulsification depends on the mechanisms of how the two phases contact each other and ultimately on the mixing, respectively, flow regime. While in classical test tube experiments, mixing might be turbulent, under laminar flow conditions in a porous medium, miscibility may slowly develop over time, depending on dispersive mechanisms facilitating the contact between the phases.
The present study investigates the developed miscibility during surfactant flooding. We perform microfluidic experiments with generic fluids and surfactant and salt concentrations, as reported in earlier studies. We observe emulsification and oil displacement in-situ and under flow conditions by optical and fluorescence microscopy. Additionally, emulsion phases were characterized by ex-situ auxiliary measurements to determine the principal phase behaviour, interfacial tension and droplet sizes.
During displacement, a sequence of displacement mechanisms and emulsion phases were observed, with the exact mechanism depending on the water salinity as a tuning parameter. At the leading front, a slight capillary instability is observed, microscopically bypassing oil and hence forming residual oil clusters. This effect is minimized at optimum salinity, leading to the best displacement efficiency. The front is followed by a phase that may be described as foam-like before a connected emulsion phase appears solubilizing ultimately remaining oil behind the displacement front. This foam-like structure facilitates a patchy, non-uniform emulsion phase with respect to phase composition (oil in water concentration). On the way to the connected emulsion phase, events are observed, that may be described as the coalescence of water droplets or alternatively, as a collapsing foam phase. The complex spatial and temporal phase distributions may cause complex flow properties at the displacement front with respect to fluid-phase mobility, which requires additional research. In the presentation, we discuss a first characterization attempt.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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