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Intrinsic Mobility control by Foam-like Emulsion?

Monday, 30 May 2022 17:35 (15 minutes)

In an earlier study, we found that oil-water-surfactant systems can form foam-like emulsion phases under porous-media flow conditions (https://doi.org/10.1016/j.jcis.2021.10.022). Those phases are especially stable far outside optimum conditions as characterized by phase behavior experiments and displacement efficiency in microfluidics. The emulsion phase displaces the oil in film flow attached to the solid surfaces, in the lamella, as well as solubilized as micro emulsion in the aqueous phase in the compartments of the foam-like structure. The results and the close similarity to a foam texture explain some earlier observations on emulsion texture, and emulsion stability against coalescence, oil mobilization and potentially emulsion phase mobility. As in foam flooding, we expect this foam-like phase to show a strongly reduced mobility, which raises the question, whether out-of-optimum emulsion phases can be used for intrinsic mobility control of surfactant flooding. This would be in close analogy to foam flooding, which is considered and used for mobility control, potentially increasing the sweep efficiency of enhanced oil recovery (EOR) operations.

The present study investigated the emulsification and flow characteristics for different surfactant concentrations in microfluidics. The foam phase textures are imaged by optical and fluorescence microscopy and phase mobility is indicated in the differential pressure measurements. We discuss the displacement mechanisms and the relation to foaming/emulsifying in detail and find consistent results in different pore structures and for different injection rates. We conclusively show that the fluid-phase mobility is highest in the optimum, substantially decreasing for non-optimal surfactant concentrations. Therefore, the observed phase may provide an intrinsic mobility control provided that a favorable surfactant concentration gradient can be established across the flood front. This may be an attractive option to enhance oil recovery but requires further research.

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References

https://doi.org/10.1016/j.jcis.2021.10.022

Time Block Preference

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

Participation

Unsure

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