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Effect of Wettability on Immiscible Liquid Displacement in 2D and 3D Porous Media

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Wettability has a dramatic impact on fluid displacement in porous media. The pore level physics of one liquid being displaced by another is a strong function of the wetting characteristics of the channel walls. However, the quantification of the effect is still not clear. Conflicting data have shown that in some oil displacement experiments in rocks, the volume of trapped oil falls as the porous media becomes less water-wet, while in some microfluidic experiments the volume of residual oil is higher in oil-wet media. The reasons for this discrepancy are not fully understood. In this study, we visualize and analyze oil displacement by water injection in 2D and 3D model porous media with different wettability. The resulting oil ganglia size distribution at the end of water injection was quantified by image processing.
Detailed information on the trapped ganglia size and morphology is presented at different flow conditions. The results show that the displacement efficiency varies with capillary number; at low capillary number, the oil-wet porous media, the displacement front was more uniform and the final volume of remaining oil was smaller, with a much smaller number of large oil ganglia and a larger number of small oil ganglia, when compared to the water-wet media. At high capillary number, the behavior is the opposite.

Time Block Preference

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

References

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