Contribution ID: **502**

Type: **Oral Presentation**

Viscous, gravitational and capillary forces in 3D experiments with a synthetic porous media

Wednesday, 1 June 2022 11:30 (15 minutes)

We explore the interplay between viscous, gravitational, and capillary forces in flow in porous media, using two different boundary conditions and employing our unique 3D-scanner, based on optical index matching [1]. Our findings are considered in comparison with experiments on 2D systems, investigating how the transitions between flow regimes can be captured by a dimensionless fluctuation number, as described in [2,3]. In both cases we look at a more viscous, more dense fluid invading a less viscous, less dense one from above. Gravity here destabilizes the invasion, but this is countered by the viscous pressure drop in the invading fluid. We capture the transition, as a function of flow rate, and find a crossover at F = 0 between viscosity-stabilized and gravity-unstable invasion. In the first case (Figure 1), we inject from a point high in a sealed cell, with an outlet at a constant pressure at the bottom. We observe a stabilized, dense invasion body near the inlet, with increasing size and a well-defined spheroid shape as we increase the flow rate. The flow transitions to unstable fingering at a radius corresponding to F = 0. In the second case, we present ongoing experiments with the same fluid pair, with the more viscous, more dense fluid now invading from above with a front initialized spanning the full cell cross section. We measure a front width that is a function of the flow rate and investigate if we also here can find a crossover at F = 0.

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References

[1] J. F. Brodin, M. Moura, R. Toussaint, K. J. Måløy and P. A. Rikvold "Visualization by optical fluorescence of two-phase flow in a three-dimensional porous medium", arXiv preprint arXiv:2008.02118 (2020).
[2] H. Auradou, K. J. Måløy, J. Schmittbuhl, A. Hansen, and D. Bideau, "Competition between correlated buoyancy and uncorrelated capillary effects during drainage," Phys. Rev. E 60, 7224 (1999).
[3] Y. Meheust, G. Løvoll, K. J. Måløy, and J. Schmittbuhl, "Interface scaling in a two-dimensional porous medium under combined viscous, gravity, and capillary effects," Phys. Rev. E 66, 051603 (2002).

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

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Session Classification: MS06-A

Track Classification: (MS06-A) Physics of multiphase flow in diverse porous media