Contribution ID: **68** Type: **Oral Presentation**

The impact of pore scale complexity on fluid invasion patterns in heterogeneous rocks

Thursday, 3 June 2021 10:00 (15 minutes)

Multiphase flow in porous rocks plays a crucial role in CO2 sequestration, subsurface energy storage and aquifer remediation. The main missing link in understanding the physics of this process is the transition from the length and time scales of a single pore to those of a macroscopic description. At the intermediate scale, intricate fluid distribution patterns emerge, closely tied to the geometry and surface chemistry of the pore space. Starting with Lenormand et al's seminal work, there has been significant progress in classifying the invasion patterns in model porous media based on e.g. the capillary number, viscosity ratio and contact angle1–3. However, it remains unclear how this translates to multi-scale, heterogeneous pore spaces typically found in geological reservoirs. We hypothesize that strong pore-scale variability in the viscous-capillary force balance may yield qualitatively new behavior in such cases. This is corroborated by fluid invasion experiments in rock samples imaged by fast micro-computed tomography. We discuss recent advances in multi-scale pore network modelling and wettability characterization to explain and classify the observed phenomena. The developed methods aim to establish a solid basis to explore when, where and why different fluid distributions occur; providing a valuable starting point to improve large-scale modelling of subsurface engineering projects.

Time Block Preference

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

References

1. Lenormand, R., Touboul, E. & Zarcone, C. Numerical models and experiments on immiscible displacements in porous media. J. Fluid Mech. 189, 165–187 (1988).
2. Zhao, B., MacMinn, C. W. & Juanes, R. Wettability control on multiphase flow in patterned microfluidics. Proc. Natl. Acad. Sci. 113, 10251–10256 (2016).
3. Holtzman, R. Effects of Pore-Scale Disorder on Fluid Displacement in Partially-Wettable Porous Media. Sci. Rep. 6, 36221 (2016).

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Primary authors: BULTREYS, Tom (Ghent University); MASCINI, Arjen (University of Gent); Mrs WANG, Shan (Ghent University); Mrs ELLMAN, Sharon (Ghent University); RUSPINI, Leo (Petricore Norway); BOONE, Marijn (TESCAN XRE); CNUDDE, Veerle (Ghent University)

Presenter: BULTREYS, Tom (Ghent University)

Session Classification: MS6-A

Track Classification: (MS6-A) Physics of multi-phase flow in diverse porous media