Contribution ID: **489** Type: **Oral Presentation**

PORE-TO-CORE LINKAGES AND UPSCALING FOR GAS INJECTION (CO2 STORAGE, EOR) IN CARBONATES

Wednesday, 1 June 2022 12:00 (15 minutes)

The flow in the subsurface is often dominated by heterogeneities with length scales ranging from micrometres to kilometres. Multiphase fluid flow is traditionally modelled using continuum approaches based on Darcy's law and macroscopic properties such as relative permeability, capillary pressure, and residual trapping. These properties are upscaled manifestations of pore-scale capillary dominated fluid dynamics. The presence of heterogeneities affects the representative elementary volume of the rocks which makes it challenging to model the multiphase flow using a continuum framework. Thus, it is crucial to study the pore-scale dynamics in heterogenous rocks and incorporate them in reservoir characterization to accurately model flow in subsurface carbonate reservoirs.

In this work, we use steady-state core flooding experiments with micro XCT imaging to study the fundamental questions relating to pore-scale fluid dynamics and their upscaled continuum representation. Mixed-wet carbonates and reservoir rocks with heterogeneities are used for the analysis. Whereas most pore-scale flow experiments are performed on mm-scale cores since larger sample size is required to capture rock heterogeneities. Here we perform core floodings with micro XCT imaging using the largest rock sample size (diameter =1.2 cm and length = 6 cm) where we can still resolve features of the pore-scale fluid dynamics. Also, the linking scales are considered between the heretofore mm scale domain of X-ray imagery and network models and the cm-m scale domain of conventional core analysis petrophysics.

We analyse the fluid distribution throughout imbibition during low capillary number flows to assess the impact of structural heterogeneities and wetting alteration. We evaluate the length scales of heterogeneity in rock flow properties, like capillary pressure characteristics, alongside length scales of wetting alteration by comparing observations of fluid distribution in the rock before and after wetting alteration with crude oil. We identify correlation lengths for the wetting state in relation to correlation length scales of rock pore structure heterogeneity. These are linked to variation in continuum flow properties (capillary pressure, relative permeability). This provides insight into modelling fluid flow in mixed wet rocks at the core scale.

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References

Time Block Preference

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

Participation

Online

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