Contribution ID: **336** Type: **Oral Presentation**

Pore-scale imaging with measurement of relative permeability and capillary pressure in an altered-wettability limestone with bimodal porosity

Tuesday, 31 May 2022 10:30 (15 minutes)

Pore-scale X-ray imaging combined with a steady-state flow experiment is used to study the displacement processes during waterflooding in an altered-wettability carbonate, Ketton limestone, with distinct bimodal porosity. We simultaneously characterize macroscopic and local multi-phase flow parameters, including relative permeability, capillary pressure, wettability, and pore-by-pore fluid distribution. A more accurate method is applied for porosity and fluid saturation determination using differential imaging without image segmentation. Typical oil-wet behaviour in resolvable macro pores is measured from contact angle, fluid occupancy and curvature on micro-CT images. The capillary pressure is negative and decreases with brine saturation as brine is the non-wetting phase and forced into small pores and throats progressively. Micro-CT images show that brine initially flows through water-wet micro-porosity, and then fills the centre of large oil-wet pore bodies. The oil relative permeability drops quickly as oil is drained to low saturation and flows through connected oil layers. The brine flows through micro-porosity and its relative permeability remains very low until brine invades small throats and forms a connected flow path in macro-pores. Once brine breaks through macro-pores, its relative permeability increases significantly because macro-pores are 3 orders of magnitude larger than micro-porosity. Due to Ketton wettability and distinct bimodal porosity, its relative permeability behaviour is markedly different when compared to other carbonates and sandstones. Overall, this work demonstrates that not only wettability but also pore size distribution have significant impacts on the displacement processes.

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Time Block Preference

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

Participation

In person

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