



Contribution ID: 418

Type: **Poster Presentation**

## Wettability Restoration of Reservoir Rocks: A Comparison between Static and Different Dynamic Methods

*Tuesday, 31 May 2022 15:20 (1h 10m)*

The wettability of reservoir rocks affects oil recovery, relative reservoir fluid flow, the capillary pressure, and the electrical characteristics of the formation, by strongly impacting the spatial distribution of fluid phases in the pore space. We investigate the effect of different aging methods on wettability restoration of strongly water-wet carbonate core plugs having similar petrophysical properties. The standard aging method, used in many core analysis laboratories, consists in immersing plugs in a small amount of crude oil for approximately 20-30 days at reservoir temperature. Here, we test wettability restoration processes following two dynamic aging procedures: i) constant flooding of crude oil for different aging times (0.03 cm<sup>3</sup>/s for 48 h and 96 h), and ii) constant aging time (72 h) using various flooding rates (0.03, 0.05, and 0.1 cm<sup>3</sup>/s), both at 80 °C. To this end, three rock samples with similar petrophysical properties, aged following the different aging methods, are used in unsteady-state oil-water relative permeability measurements. The outcomes of these core flooding experiments reveal a shift in the crossing point of oil-water relative permeability curves for each plug. The changes in oil-water crossing point saturations are thus used as a proxy for wettability changes; they are recorded in water saturations of almost 53% to 67% indicating wettability changes from mixed-wet to oil-wet state. Based on that proxy, the static aging method is observed to be less successful than the dynamic aging methods. Furthermore, for the constant aging period dynamic method, there is an ideal crude oil injection rate that is most effective at changing the wettability in terms of the injected pore volumes that are needed and the achieved wetting preference.

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### MDPI Energies Student Poster Award

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### Country

France

### References

- [1] Anderson WG. Wettability literature survey-part 1: rock/oil/brine interactions and the effects of core handling on wettability. *J Pet Technol* 1986;38:1-125.
- [2] Derikvand Z, Rezaei A, Parsaei R, Riazi M, Torabi F. A mechanistic experimental study on the combined effect of Mg<sup>2+</sup>, Ca<sup>2+</sup>, and SO<sub>4</sub><sup>2-</sup> ions and a cationic surfactant in improving the surface properties of oil/water/rock system. *Colloids Surfaces A Physicochem Eng Asp* 2019;124327.

- [3] Rezaei A, Khodabakhshi A, Esmaili A, Razavifar M. Effects of initial wettability and different surfactant-silica nanoparticles flooding scenarios on oil-recovery from carbonate rocks. *Petroleum* 2021.
- [4] Fernø MA, Torsvik M, Haugland S, Graue A. Dynamic laboratory wettability alteration. *Energy & Fuels* 2010;24:3950–8.

## Time Block Preference

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

## Participation

Online

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