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Contribution ID: **643** Type: **Oral Presentation**

Evolution of Bentheimer Sandstone Wettability During Cyclic $scCO_2$-Brine Injections

Thursday, 3 June 2021 11:15 (15 minutes)

Geologic sequestration in sedimentary formations has been identified as a potential technology to prevent climate-change inducing carbon dioxide (CO_2) from being emitted to the atmosphere. In order to achieve safe and effective storage underground, accurate understanding and predictions of CO_2 behavior in subsurface rock formations is required; including quantifying how much CO_2 is trapped within pore spaces by capillarity (vs. how much remains mobile), and constraining the occurrence of physio-chemical reactions between CO_2 and the mineral matrix. Experiments where multiple cycles of CO_2 and brine are injected into rock samples have produced conflicting results; likely due to differences in mineral content of samples, pressure-temperature conditions, the suite of aqueous chemistry parameters which may impact results, and experimental apparatus and protocol. We present a new set of experiments, designed to replicate the conditions of a previous study, but with a new experimental design, apparatus, and timeline. We confirm the previous results that demonstrated shifts in CO_2 trapping behaviour over multiple injection cycles, and we conduct additional analyses to discern the fluid-fluid macroscopic contact angle, curvature, interfacial area, and topology of trapped CO_2 ganglia. The results are considered in the context of two mechanisms that could cause evolution of CO_2 behavior; (1) mineral fines migration, and (2) solubility-induced CO_2 adhesion and wettability alteration. We do not observe significant evidence of fines migration in this "clean" Bentheimer sandstone system. Conversely, Lattice-Boltzmann simulations based on the proposed conceptual model of wettability alteration exhibit similar trends in pressure measurments, end-point saturation levels, and CO_2 ganglia morphological characteristics as experiments, indicating that the changes observed in experiments could be due to wettability alteration as proposed. We observe that this wettability alteration renders CO_2 more stable in the rock pore space, increasing capillary trapping over four injection cycles.

Time Block Preference

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

References

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