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Insights into safe CO2 injection and storage scenarios in tight chalk reservoir samples

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Storing CO2 in the depleted North Sea chalk reservoirs represents a potentially attractive and cost-effective way to reduce the environmental consequences of emissions of CO2. In this study we present a comprehensive investigation of CO2 injection in chalk under different in-situ conditions which includes characterization of 1) the response of chalk to CO2 injection in the short and long term, and 2) the response of seismic measurements to various flow and mechanical alterations. The experiments are carried out on core material from a specific target reservoir in the Danish North Sea and the core plugs are saturated with relevant formation water and mounted in a pressurized injection cell at varying temperatures. Supercritical CO2 is injected into the core and the produced CO2 volume, the seismic response, and the chemical composition of the produced brine are monitored. The brine samples are analyzed for Ca2+ and other major ions in the formation brine and show the extent of calcite dissolution in the core plugs as well as other minerals being produced as a consequence of CO2 injection. In addition to the injection experiments, static experiments are presented where brine-saturated core plugs are stored for three months in contact with CO2 directly, in contact with brine in equilibrium with CO2, and with CO2 injected into the core. The core material is investigated by CT-scanning before and after the experiments and exposed to geomechanical testing to measure the extent of any rock material alteration. The knowledge gained through advanced core flooding, static exposure experiments, CT imaging, and geomechanical experiments can help to de-risk CO2 injection and storage in chalk reservoirs and will be helpful for de-risking other types of carbonate reservoirs for CO2 storage.

Participation

In-Person

References

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