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The effect of the diffusion transport on CO2-water-rock reactions in CO2 sequestration condition

Thursday, 3 June 2021 10:00 (15 minutes)

Due to the high storage capacity and the long-term sequestration safety, geological CO2 mineralization in mafic and ultramafic reservoir has been widely researching via laboratory and field studies. Previous researches mainly focus on the dynamics of CO2-water-rock interactions in well-mixed constant pressure system, few studies have been carried out with pressure decay while CO2 mineralization happened.
In this study, a series of high-temperature, high-pressure static experiments was conducted to simulate CO2、water-saturated olivine diffusion and reaction coupled processes investigating the impact of transport limitation, mineralization and grain size distribution. Once the injection of CO2 in the formation, CO2 diffuse into the brine, followed by the reaction with rock. During the long-term reaction, the CO2 pressure continue to decrease monotonically, particularly showing a proposed linear relationship with time in the later time, and indicating that CO2 is constantly consumed and permanently sealed. A one-dimensional diffusive mass transfer model has been used to attain the dynamic diffusion coefficients, quantifying the effect of mineralization and grain size distribution on the mass transfer of CO2, which are little higher than the pure diffusivities without reaction. And the comparison of Raman test results before and after the reaction at different heights show the dissolution of forsterite and chlorite, precipitation of magnesite, even in the deepest. The distribution and quantity of carbonate minerals along the depth direction, showing a non-uniform distribution trend resulting from localized and chemical gradient, was determined using XRD and total carbon analysis.
In combination, the results refine the understanding of coupled reactive and transport effects in geologic carbon sequestration, which is the primary mechanism in CO2 mineral trapping process.

Time Block Preference

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

References

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