Kinetic geochemical modelling of brine-water chemistry as consequences of hydrogen injection

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Hydrogen is an efficient and flexible energy carrier and can be produced from the surplus of renewable energy. It has been claimed to be an appropriate alternative to fossil fuels especially in the area of transportation. Storage of hydrogen in geological formations would provide the required capacity for a hydrogen-based energy supply. However, there are many open questions to be solved with regards to the chemical interactions between hydrogen and reservoir rock formations.

Here we present a kinetic modeling study on the interactions between injected hydrogen and the reservoir brine that might further affect the integrity of the reservoir or the purity of recovered hydrogen. The study was carried out using the brine composition of the target reservoir and using Geochemist's Workbench (GWB) as modeling tool.

Not much is known about effective reaction rates between hydrogen and reservoir brines. Our study is focusing on the sensitivity of reaction rates to the effective rate constants and gas fugacity.

Our results indicate that if hydrogen comes in contact withbrine, it partly dissolves and get consumed in solution. Also changes in pH towards alkalinity and changes in the aqueous species concentrations were observed. We further show the reduction of complexions such as HCO_3^- and SO_4^- into CH_4 and HS^-. To complete the analysis, sensitivity of reaction rates of these redox couples have been investigated.

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