

SO₂ solution, hydrolysis and disproportionation at geological storage conditions in the system CO₂-SO₂-H₂O

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In the context of geological CO₂ storage, the influence of accessory gases in the CO₂ stream on properties of saline brines in deep aquifer storage complexes and on gas-fluid-rock reactions has to be considered. As a prominent component in flue gas from coal combustion, sulfur dioxide is considered of prime importance. Due to a lack of data on the kinetics of the solution rate of SO₂ in saline brine at in situ conditions – and especially the kinetics of the hydration, hydrolysis and feasible additional redox reactions as disproportionation to sulfate and sulfide, studies involving quantitative modelling of geochemical reactions in the reservoir and their influence on injectivity and storage capacity are yielding contradictory results [1, 2, 3, 4, 5, 6].

As proposed by [6] we therefore determined additional data on the kinetics of solution of SO₂ in NaCl-dominated saline brine at 333 K and 16 MPa in stirred all-titanium high pressure reactors. The solution of SO₂ from a CO₂-SO₂ phase into the aqueous fluid and the speciation of sulfur was monitored. Analysis of trace concentrations of sulfite, thiosulfate and sulfide after derivatisation with a fluorescence tag by HPLC-FD and sulfate by IC enabled the quantification of reaction rates for the individual reactions at in situ conditions and constrained their influence on pH, the oxygen fugacity as well as on the solubility of CO₂.

[1] Tan *et al.* (2013) *Ind. Eng. Ch. Res.* **52**, 10864-10872. [2] Crandell *et al.* (2010) *ES&T* **44**, 349-355. [3] Ellis *et al.* (2010) *Int.J.G.G.C.* **4**, 575-582. [4] Ovaysi *et al.* *Int.J.G.G.C.* **15**, 119-133. [5] Xu *et al.* (2007) *Chem. Geol.* **242**, 319-346. [6] Pearce *et al.* (2015) *Chem. Geol.* **399**, 65-86.