

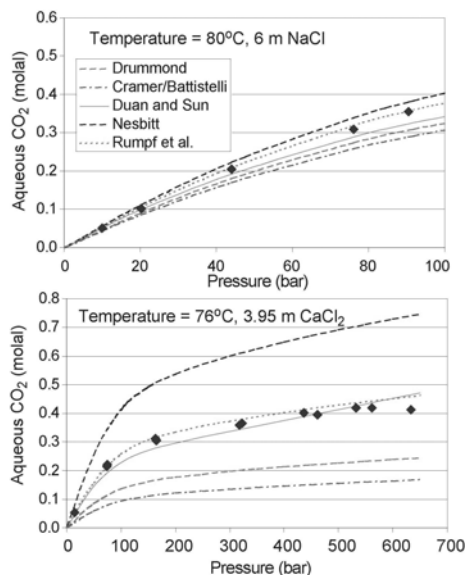
A non-iterative model for H₂O-CO₂ mutual solubility in chloride brines

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Evaluating the feasibility of CO₂ geologic sequestration requires intensive numerical simulations of multiphase fluid flow. Such simulations involve the calculation of P-T-X data for mixtures of CO₂, H₂O and various salts as a function of temperature, pressure and salinity. A numerically efficient thermodynamic model was developed previously [1] for phase partitioning without salt effects, and was shown to provide an excellent match to experimental data in the range 12–100°C and up to 600 bar. Here, the model is extended to NaCl and CaCl₂ solutions by including activity coefficients for aqueous CO₂ derived from several literature sources. Two of these sources [2,3] yield the best results. The approach allows computing mutual solubilities in a noniterative manner with an accuracy typically within experimental uncertainty for solutions up to 6 molal NaCl and 4 molal CaCl₂ (Figure 1).

Figure 1. Measured (symbols) versus predicted (lines) CO₂ solubilities using five different activity coefficient models.



References

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Iodide adsorption and transport at the Hanford Site, Washington

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Introduction

Because of its long half life (¹²⁹I ($t_{1/2}=1.6 \times 10^7$ years) and high mobility in the subsurface environments, batch adsorption/desorption and flow-through column experiments were conducted for radioactive iodide (¹²⁵I and ¹²⁹I) on sediment from Intergrated Disposal Facility (IDF) which is a proposed low-level radioactive waste disposal facility at the HanfordSite.

Results and discussion

Adsorption experiments conducted with groundwater spiked with dissolved ¹²⁵Iodide showed that iodide adsorption was very low ($K_d=0.2$ mL/g) at pH 7.5 and decreased with increasing pH. Adsorption linearity was found up to a total concentration of 100 mg/L dissolved iodide. The results of desorption experiments revealed that up to 60 % of adsorbed iodide was readily desorbed from the sediment after 14 days by iodide-free groundwater. The calculated desorption K_d determined using the ratio of the concentration of iodide in the desorbing solution after 14 days of contact was 1.4 ml/g. The desorption K_d was significantly greater than the adsorption K_d of 0.2 ml/g, which indicated that iodide adsorption was not fully reversible at these geochemical conditions (Hanford groundwater at pH 7.5).

Column experiments showed that ¹²⁹I transport behavior through the same sediment was slightly retarded compared with that of the non-reactive tracer (³H). Slight retardation of ¹²⁹I was noticeable in low pore volumes and long tailing was also found in the later stages of the breakthrough curve. The CXTFIT modeling fit to the observed data showed $K_d=0.17$ ml/g, consistent with $K_d(0.2$ ml/g) obtained from batch experiments.

Conclusions

Both batch adsorption and column experiments revealed that ¹²⁹I was highly mobile at the Hanford Site. The high mobility of ¹²⁹I is a major consideration in predicting the risks associated with existing and potential future release of ¹²⁹I to the subsurface geochemical environment at the Hanford Site and other locations.