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Inhibition of $CaCO_3$ precipitation – experimental study

A. Niedermayr (1), M. Dietzel (1), S. J. Köhler (1) and A. Leis (2)

(1) Institute of Applied Geosciences, Graz University of Technology, Austria, (2) Institute of Water Resources Management, Joanneum Research Graz, Austria (a.niedermayr@tugraz.at / Fax: ++43-316-8736876 / Phone: ++43-316-8736362)

Inhibitors for $CaCO_3$ precipitation like magnesium ions and polyaspartic acid are tested with two different experimental setups at pH = 8.3 and T = 25˚C. In the first set of experiments CO_2 is continuously liberated into a metal and inhibitor bearing solution through a thin semipermeable membrane. The pH is kept constant by automatic titration with diluted NaOH (pH-stat). In these experiments we obtain varying supersaturation degrees with respect to $CaCO_3$ polymorphs to decipher precipitation rate effects. In the second set of experiments a $NaHCO_3$ solution is mixed with a metal and inhibitor bearing solution in a gas tight reactor to study the induction time of $CaCO_3$ precipitation at pH-stat conditions. During all experiments the evolution of the chemical composition as well as the final solids were analysed.

Induction time significantly increases with increasing magnesium concentration. Preliminary results show similar behaviour in the presence of polyaspartic acid. Elevated initial Mg concentration in the solution induces the formation of fine spicular aragonite crystals (thickness of about 1 μm and a length between 3 and 10 μm) with a high specific surface area while relatively huge calcite crystals (about 15 to 40 μm) at low Mg content are obtained. In principle, the sequence of $CaCO_3$polymorph precipitation may be followed by the concentration of aqueous Mg and traces of Sr as a function of reaction time. The evolution of element distribution in $CaCO_3$ precipitates provides insight into precipitation mechanisms using different inhibitor agents.