Experimental study of CO_2 sequestration via goethite carbonation

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Mineral carbonation in geological formations is the fixation of CO_2 as stable carbonate minerals, such as calcite ($CaCO_3$), dolomite ($CaMg(CO_3)_2$), magnesite ($MgCO_3$), siderite ($FeCO_3$) and Mg-Fe carbonate solid solutions [1]. This is one of the promising methods proposed to mitigate increasing atmospheric CO_2.

The objective of this research is to study if goethite (FeO(OH)), a common mineral in soils, could be replaced by siderite or other iron carbonates in the presence of carbonate solutions. To test this hypothesis we have performed a series of experiments with goethite as the starting mineral using *in situ* Atomic Force Microscopy (AFM) experiments at room temperature, CO_2-water solution at pH 3.5, $NaHCO_3$ aqueous solutions at different concentrations and pH (3.5-8). As well, we have performed similar ex-situ hydrothermal experiments, under a range of temperatures (50-150 $^{\circ}$C) for 7 days. After reaction, product phases were characterized using Raman spectroscopy and Scanning Electron Microscopy (SEM).

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[1] Gislason S.R. et al. Mineral sequestration of carbon dioxide in basalt: A pre-injection overview of the Carb-Fix project. *International Journal of Greenhouse Gas Control*. **4**, 537-545 (2010).