Abstract

In mineral dissolution reactions, surface morphologies play important roles particularly in near equilibrium fluids where generation of new sites of reactivity (e.g., pit nuclei) is thermodynamically disfavored. Following CO2 injection in geologic formations, dissolution of primary carbonate minerals and crack-sealing cements will occur. The impact of these reactions on fluid chemistry requires better understanding of the reaction kinetics of major minerals at close-to-equilibrium conditions. Initial Investigations have focused on quantifying calcite dissolution using short residence time (~ 10 min) flow through reactors to obtain dissolution rates at 60oC, pH = 8.33 and Pco2 = 3.8 × 10^-4 atm. Dissolution rates decreased exponentially with time, however, the time to achieve a steady dissolution rate was approximately 120 h, suggesting that surface morphology undergoes significant changes during reaction rate decay. These observations are important in the context of the interplay between surface microtopography and reaction rates and will be discussed in light of atomic force microscopy investigations. From the experimental data in this study, the predicted relaxation time, τ is found to be ~ 30 h which is relatively larger than previous observations. The difficulty in etch pit formation and the presence of impurities is found to influence τ at very near equilibrium states.