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Insights into the Dissolution Kinetics of Thermally Activated Serpentine for CO₂ Sequestration

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Abstract

The rate-determining step in the aqueous carbonation of serpentine minerals is the dissolution of Mg from serpentine. The dissolution rate of minerals largely depends on the pH of the solution and the size of serpentine particles. In the present work, an experimental method has been developed to study the dissolution rate of heat activated serpentine (lizardite polymorph) in a wide range of pH, solid to liquid ratio and particle size at room temperature. The results allowed us to determine the effect of these variables on the dissolution kinetics of heat activated lizardite, which represents crucial kinetic data for accurately modelling the carbonation rates of serpentine. Additionally, amorphous Si re-precipitation at high solid to liquid (S/L) ratio and pH 6.1 was demonstrated. These provide essential data for the design and optimisation of industrial mineral carbonation processes. For the first time, the crackling core model (CCM) was applied to model the dissolution kinetics of heat activated lizardite in acidic solutions. Applying the CCM model to a wide range of particle sizes provides useful information on the mechanism of the dissolution of heat activated lizardite and the range of particle size for which the

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