

## **Carbonate mineralization using Ca(OH)<sub>2</sub> suspensions for CO<sub>2</sub>(g) capture and storage (CCS) at room temperature**

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In the 21<sup>st</sup> C atmospheric CO<sub>2</sub>(g) has become a major concern for the global warming due to the excessive anthropogenic production. Carbonate mineralization is considered as a potential approach to capture anthropogenic CO<sub>2</sub>(g). Furthermore, it would be beneficial if the solid products of this process can be recycled for industrial utilization. Despite the easiness and the probable advantages, carbonate mineralization has not been proven to be economically feasible mainly due to the amounts of CO<sub>2</sub>(g) generated during the whole process being larger than those captured by the process. Consequently, the development of novel techniques to overcome the limitation is necessary for the practical application of this process. This study examined the reaction processes of carbonate mineralization using Ca(OH)<sub>2</sub> suspensions. Pure Ca(OH)<sub>2</sub> was used as an ideal model compound for providing Ca<sup>2+</sup> ions and alkalinity, which are essential for carbonate solid formation.

Batch experiments were conducted by reacting pure CO<sub>2</sub>(g) with varying concentrations of Ca(OH)<sub>2</sub> suspension ([Ca(OH)<sub>2</sub>]<sub>0</sub> = 20, 27, 135, 270, 675 mM) at room temperature. CO<sub>2</sub>(g) was purged into the suspensions for 60 min at 0.1 L/min. The initial pH of the Ca(OH)<sub>2</sub> suspensions was stable at 12.5±0.2. After injecting CO<sub>2</sub>(g), the pH of the suspensions decreased rapidly to 6.3±0.2 in every case, except of 675 mM Ca(OH)<sub>2</sub> (12.5±0.2). Concurrently, [Ca<sup>2+</sup>] decreased to a minimum value (1.0±0.5 mM) mainly due to the precipitation of CaCO<sub>3</sub>. Subsequently, [Ca<sup>2+</sup>] rebounded and reached a value corresponding to the solubility of calcite (10.0 mM) at the pH of the suspensions (6.3±0.2). Semi-quantitative XRD analyses indicated that 95% wt. of the initial Ca(OH)<sub>2</sub> was rapidly transformed to CaCO<sub>3</sub> within 15 min at [Ca(OH)<sub>2</sub>]<sub>0</sub> = 135 mM. These results suggest a positive prospect of controlling carbonate mineralization process for the potentiality of its practical application .