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Polymorph and morphology of $CaCO_3$ in relation to precipitation conditions in a bubbling system

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Polymorph and morphology of $CaCO_3$ in relation to precipitation conditions in a bubbling system☆

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Abstract

Simulating the typical carbonation step in a mineral CO_2 sequestration, precipitated calcium carbonate (PCC) were prepared by bubbling CO_2 gas into a rich Ca solution. These carbonation reactions were conducted at three pH ranges, namely 10.0-9.0, 9.0-8.0, 8.0-7.0, in which temperature and CO_2 flow rate are additional experimental variables. The PCC obtained in experiments were examined by fourier transform infrared spectroscopy (FTIR) and X-rays diffraction (XRD). It was found that supersaturation determined by pH value and flow rate of CO_2 has significant influence on polymorph of PCC. Vaterite was preferably formed at high supersaturation, while dissolution of metastable vaterite and crystallization of calcite occurred at low supersaturation. High temperature is critical factor for formation of aragonite. At 70 ℃, it was found vaterite, calcite and aragonite were coexisted in PCC because transformation from vaterite to aragonite via calcite occurred at this temperature. Scanning electron microscopy (SEM) technology were performed on prepared PCC, various morphologies consistent with polymorphs were observed.

Key Words: precipitated calcium carbonate; rich Ca solution; bubbling CO_2; pH range; polymorph; morphology.

1. Introduction