

Crystal morphologies of CaCO₃ precipitated from REE-doped solutions

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In an aquatic system, additives often influence crystal phase and morphology of calcium carbonate by inhibiting or enhancing its crystal growth. Recently, it was suggested that a trace of lanthanum ion (La³⁺) stabilizes vaterite and inhibit the crystal growth of calcite. However, the mechanisms of the stabilization and inhibition have not been revealed yet. In the present work, We investigated the crystal morphologies of vaterite and calcite precipitated from solutions with the presence of REEs (lanthanum and ytterbium) by using electron back-scattering diffraction (EBSD) technique which enables us to obtain crystallographic information from specimens in a scanning electron microscope (SEM). Besides, the pH measurement, XRD and EPMA analyses were conducted to comprehend the behavior of lanthanum or ytterbium ion in solutions and precipitates.

In lanthanum-doped (10 or 20 microM) system, calcite showed a strange-shaped morphology. The crystal consists of three blades that extend along the glide planes. On the other hand, morphology of vaterite showed no change from that precipitated in non-doped solution. Thus it can be proposed that lanthanum ion inhibits only the crystal growth of calcite and consequently prolongs the lifetime of vaterite in the vaterite-calcite transition in solution.

In the case of ytterbium-doped system, the crystallization of vaterite was not observed at all. When the concentrations of ytterbium ion in starting solution were 10 microM and 20 microM, the crystallization of calcite was also delayed. However, when the concentration was 5 microM, the crystallization of calcite was enhanced. Hence, it can be suggested that the presence of ytterbium ion inhibits the crystallization of vaterite and enhances that of calcite, rather than prohibited that of both.