

Observation of mineral growth by using fluorescence imaging

*Jun Kawano¹

1. Faculty of Science, Hokkaido University

Certain minerals emit fascinating fluorescence under UV light. Furthermore, UV irradiation can sometimes reveal internal patterns invisible under normal light, allowing us to analyze the growth history of minerals. Our group is developing a technique to analyze crystal growth by visualizing the invisible patterns under UV light with fluorescent probes. Fluorescent probes change their fluorescence intensity in response to pH/ion concentration when UV light is shone on a dissolved solution. Therefore, conducting growth/dissolution experiments of minerals in such a solution allows us to visualize pH and ion concentration around the reacting minerals.

Using this method, we simultaneously visualized the pH and Ca ion concentration around CaCO_3 , calcite, dissolving in aqueous solution. The results showed a concentric increase in pH and calcium ion concentration around the crystal. Quantitative analysis suggested that the pH increase was smaller than expected based on changes in calcium ion concentration, indicating that reactions at the crystal surface may differ from those in the bulk. This result also impacts interpretations of the CO_2 balance in carbonate mineral reactions. Furthermore, visualizing local pH around CaCO_3 forming within a gel matrix confirmed a decrease in pH toward the crystal. This tendency varies depending on the polymorphs, suggesting that differences in ion behavior around crystals influence the formation mechanism. This technique can also be applied to analyze the relationship between crystal morphology and changes in the surrounding environment, and further progress from various perspectives should be expected.

Keywords: visualization, pH, calcium carbonate