

Reaction kinetics of Mg-carbonates

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Mineral scale formation is a common and costly phenomenon in many processes handling with aqueous solutions. Carbonate precipitation e.g. is responsible for lost efficiency in heat exchangers and boilers. The retrograde solubility of carbonates is the driving force to produce these scaling minerals. Nevertheless, Mg plays a crucial role in the carbonate system. While influencing precipitation rates of calcite and even being decisive for the final CaCO_3 polymorph formation, the formation of anhydrous Mg-carbonates seems to be inhibited.

To constrain the influence of Mg in the carbonate system a better understanding of the reaction kinetics of Mg-carbonates is needed. Main Mg-carbonates encountered in natural environments are e.g. dolomite, magnesite and hydromagnesite. In order to investigate their reaction kinetics the first step was devoted to the respective synthesis of pure phases. The reactivity of synthesized phases can then experimentally be compared to the reactivity of natural samples.

Synthesized and natural products were used to run macroscopic experiments. Reactivity of hydromagnesite was investigated using low temperature batch reactors. Growth kinetics of magnesite were investigated using hydrothermal mixed-flow reactors while dolomite experiments were performed using hydrothermal batch reactors.

A further approach to assess the reactivity of a mineral is using high resolution microscopy. Following this attempt hydrothermal atomic force microscopy was applied to investigate dolomite reactivity on the (104) surface. The peculiar template growth behaviour of dolomite is shown in figure 1. Besides supersaturation and aqueous Ca/Mg-ratios the conducted experiments indicate the importance of elevated temperatures for the dolomite growth process.

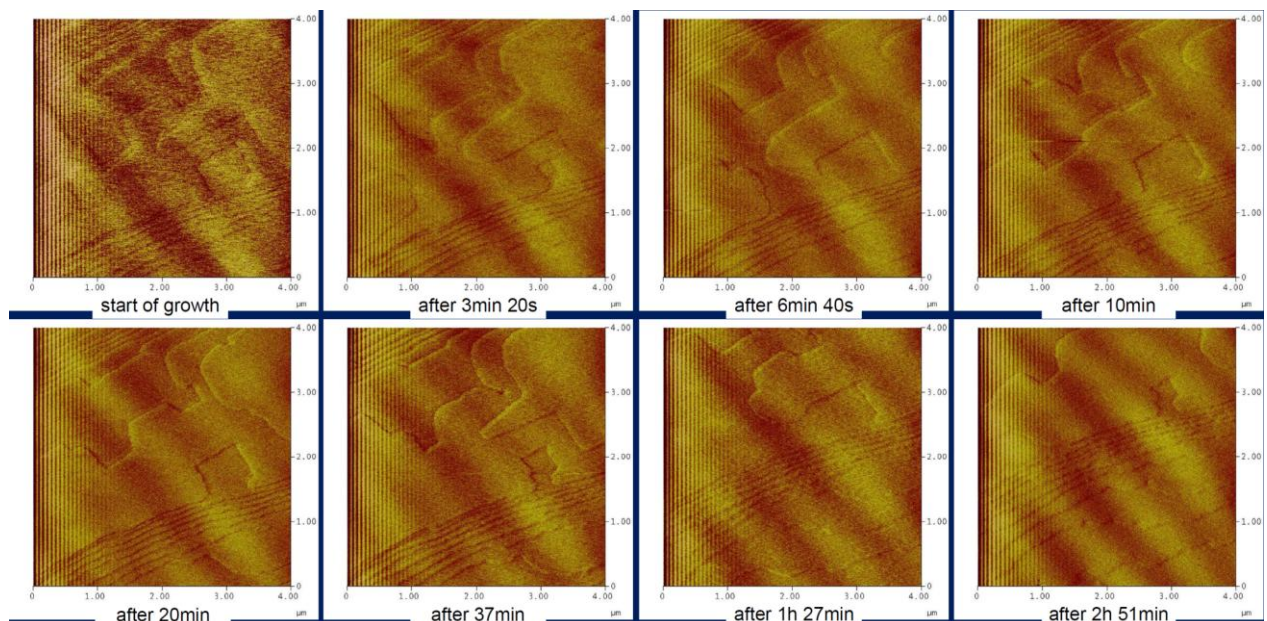


Fig. 1: Sequence of deflection images showing a template effect during dolomite growth.