

## How biopolymers control calcite precipitation

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The kinetics of calcite precipitation, in the presence of the biopolymers, alginate and polyaspartate, was investigated with the constant composition technique. When calcite growth begins, in the presence of biopolymers even at very low concentration, the mechanism of calcite precipitation changes from spiral growth to exponential or surface nucleation mediated growth. This was confirmed by the analysis of the dependence of calcite precipitation rate, as well as by the induction period, on supersaturation with respect to calcite. Atomic force microscopy (AFM) images (Fig. 1) showed the formation of surface nuclei resulting in the birth-and-spread growth of calcite that is observed with scanning electron microscopy (SEM) (Fig. 2).

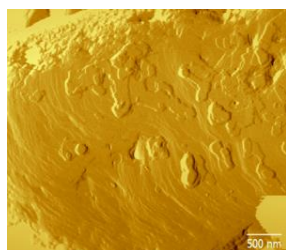


Fig. 1. AFM deflection image of the surface of a calcite crystal, precipitated in the presence of polyaspartate.

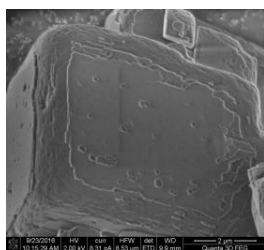


Fig. 2. SEM image of a calcite crystal showing birth-and-spread growth in the presence of polyaspartate.

The change of growth mechanism can be caused by the hindrance of formation and advance of growth steps by adsorbed biopolymers. Another reason could be a substantial decrease of the effective interface energy, which was reduced by almost a factor of two, with tenfold increase of polymer concentration. The decrease of interfacial surface energy was confirmed by surface free energy derived from vapor adsorption measurements.