High-resolution imaging of $CaCO_3$ particles in liquid by FM-AFM

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Calcite is used for a wide range of industrial applications including cement, papers, cosmetics, foods, etc. In nature, calcite is one of the most abundant minerals and structural materials for creatures. Rode et. al.[1] recently achieved atomically resolved imaging of a calcite single crystal in water using a frequency-modulation atomic force microscope (FM-AFM). In the present study, we have tried and succeeded in high-resolution imaging of nanometer-sized calcite particles immersed in water.

A major problem of imaging particles in liquids was particle migration. Dispersed particles to an atomically flat substrate such as graphite provided an efficient way of immobilization. The other problem is removing contaminants and damaged layers from particle surface. This was efficiently done by limited but finite dissolution of calcite into water.

Figure 1 presents constant frequency-shift topography of calcite particles immobilized on a graphite wafer. Particles securely fixed on the substrate were visualized in image (a). Atomistic corrugations were further resolved in a zoomed-in image of panel (b).

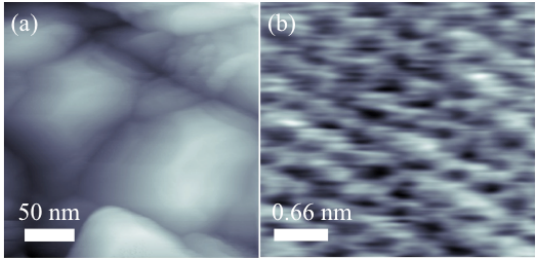

Fig. 1 Constant frequency-shift topography of calcite particles immobilized on graphite. Cantilever oscillation amplitude: (a) 2.5 and (b) 2.0 nm. Frequency shift: (a) 110 and (b) 470 Hz.

1) S. Rode, N. Oyabu, K. Kobayashi, H. Yamada, A. Kühnle, Langmuir 25 (2009) 2850.