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Mesoscopic textures of biogenic and biomimetic calcite crystals

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The mesoscale granular textures having a single crystalline feature are generally observed on the continuous body of various biogenic and biomimetic calcite crystals. The distribution of the organic phase and lattice strain in the textured crystals vary with organism species or the growth conditions. The prismatic layer of a fan mussel, A. pectinata, exhibits a relatively homogeneous, low-strain texture consisting of the nanoscale grains with discrete organic inclusions; the prism structure of a pearl oyster, P. fucata, and an avian eggshell have a high-strain granular texture with localized organic phases. A variety of the mesoscopic textures similar to the biogenic calcite crystals are artificially produced in a supersaturated solution containing specific organic molecules. The high-strain textures were produced through mesoscopic dendritic growth of calcite by physical impedance of a rigid gel matrix and subsequent thickening of the branches. Continuous growth of the crystal involving nanoscale segregation of soluble polymers would result in the formation of the low-strain body having mesoscopic textures. The chemical durability of the low-strain biogenic and biomimetic textured calcites are enhanced by the combination of the inorganic crystal and the organic molecules.

Keywords: Biomineral, Calcium carboate, Mesocrystal