

Templated biomineralization on self-assembled protein fibers

Beamline: X6B

Technique: X-ray Diffraction

Researchers:

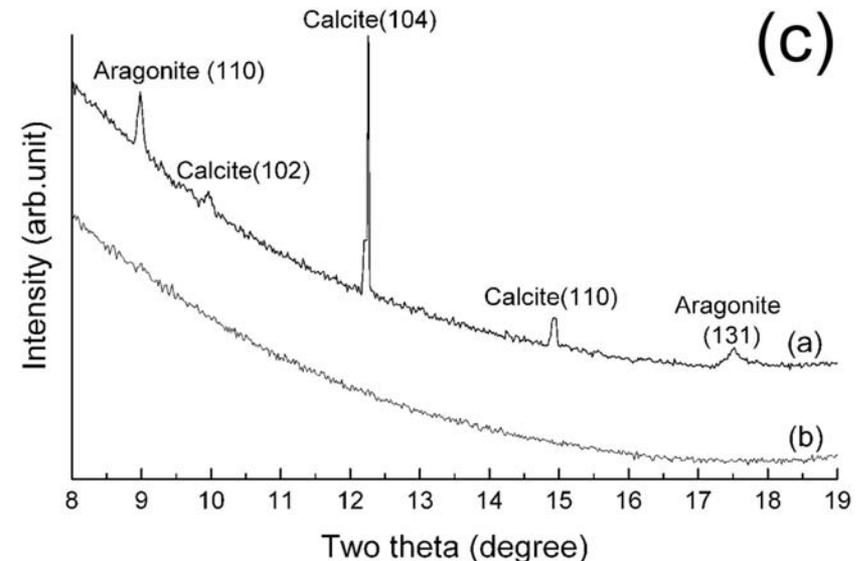
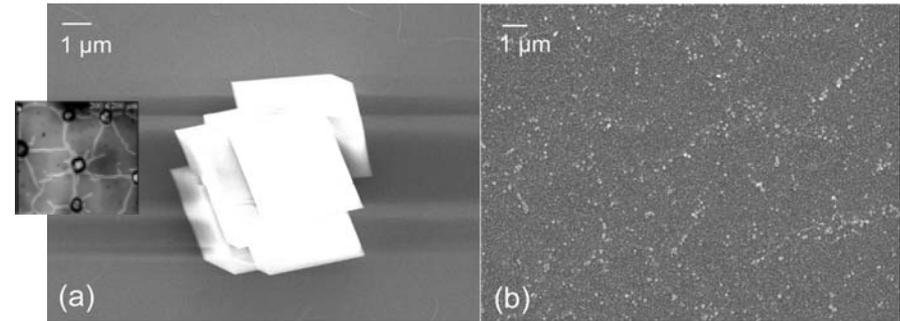
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Publication:

K. Subburaman et al, "Templated biomineralization on self-assembled protein fibers" *Proc. Nat. Acad. Sci.* **103** (2006) 14672.

Motivation: Extracellular matrix proteins control mineralization in specific ways, nucleating crystals to create composite tissues with specific structure and function. Understanding this process is important for tissue engineering and for medical treatment of bone.

Results: Elastin and fibronectin, important tissue proteins, were compared as nucleation templates. These proteins form fiber networks similar to the natural extracellular matrix. Atomic force microscopy, SEM, and ion scattering demonstrated that only the fibrous regions nucleate mineral. X-ray diffraction demonstrates that elastin forms calcite. Fibronectin forms amorphous mineral. Thus, protein structure impacts biomineralization. In particular, calcite is implicated in pathological arterial mineralization.



Elastin proteins nucleate calcite crystals (a) near the hydrophilic crossings of the fibers (inset). These fibers have similar morphology to the extracellular matrix. Fibronectin, an equally important tissue protein, also forms fibers but these do not nucleate calcite (b). X-ray diffraction was used to measure the crystallinity of samples grown under various conditions (c).