

## **Geometric characterization of structure-property relationships in biomimetic systems for use in mechanically robust materials**

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Hierarchically structured biominerals are made from common and mechanically unimpressive constituents, but the spatial distribution of these elements combine to form ultrastructures which display extraordinary mechanical properties. In the case of stomatopods they have evolved a dactyl club capable of receiving high velocity impacts in order to break through the hard exteriors of their heavily armored prey. By performing structural and property measurements on the mineralized dactyl club we can begin to identify structure-function relationships which can be modeled and synthesized. We have performed SEM, EDS, RAMAN, Synchrotron, XRD, polarized light microscopy, and nanoindentation. We have begun modeling (FEM) the structures observed, and developing synthesis techniques which can recreate the observed geometries. In attempting to make lightweight, flexible, and impact resistant materials, other organisms for inspiration include cuttlefish for their ability to create highly porous (thermally resistant) yet strong cuttlebone, and sea urchins whose spines are quite flexible for a ceramic.