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BIO-INSPIRED HYBRID NANOCOMPOSITES IN SINGLE CRYSTALLINE HOSTS; FROM STRUCTURE TO FUNCTION

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Key Words: nanocomposites, hybrid materials, hybrid interfaces, bandgap engineering, bio inspired.

Often crystals in nature exhibit fascinating mechanical, optical, magnetic and other characteristics. Such natural single crystals are very different than man-made crystals: they are in fact hybrid nanocomposites due to the incorporation of organic molecules within heir crystalline lattice and often reveal intricate shapes and morphologies rather than clear facets.
In this talk I will show that we can emulate these two specific features demonstrated by organisms so as to form new structural materials with new properties and characteristics.
I will show that we can grow inorganic single crystals in which different organic molecules are incorporated on a nanometer scale. This incorporation has pronounced effects on the crystal structure of the crystal host and depending on the choice of materials can enhance the mechanical properties, manipulate its electronic properties and even serve as a drug delivery platform with highly controlled release properties.
I will also show that using this bio-inspired approach we can grow functional single crystals that demonstrate no facets but rather have intricate shapes such as nanoporous morphologies (nano sponge) or curved surfaces and yet maintain their single crystal nature.
We believe that our approach will open up new ways to control the structure and properties of smart materials.

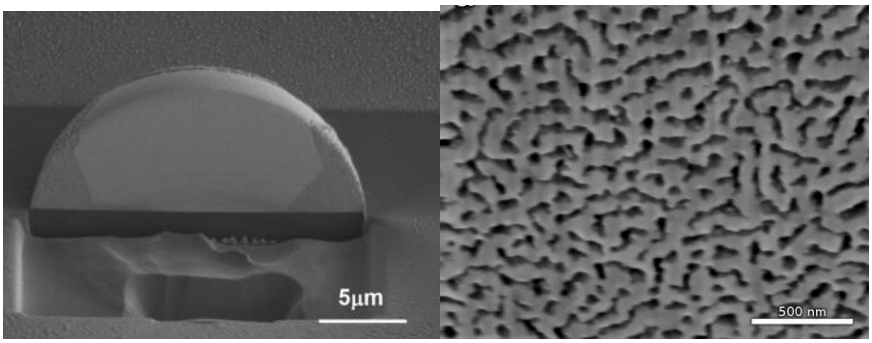

Figure 1 – Examples of single crystals which exhibit curved surfaces (left) or nanoporous morphologies

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