

Biomimetic mineralization approach toward high-performance composites

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Biomaterials and their formations often provide material scientists a source of inspiration in developing advanced materials. The sea urchin teeth, for example, made of calcite grind down lime stones which are also composed of calcite. For better mechanical grinding performance, the sea urchin teeth have two cooriented polycrystalline blocks which interdigitate near the grinding tip. Photosensitive brittle star makes use of microlens arrays to focus incident light into nerve bundles more effectively. The microlens arrays of brittle star are composed of single crystalline calcite, which has birefringent nature only except along the optical axis. Surprisingly, brittle star has non-birefringent optical microlens arrays with the optical axis in perpendicular to the arrays. In this talk, the general introduction with some studies of biogenic and biomimetic minerals focused on the relationship between structure and function will be given. The recent work on calcium carbonate microlens arrays will be presented more specifically, with structural characterizations leading to elucidation of the formation mechanism as well as optical properties, which suggests taking advantage of biomineralization approach for the synthesis of advanced optical materials.