Control of Crystal Phase Switching and Polymorphism by Mollusk Shell Macromolecules

Cheong Song Choi
Department of Chemical Engineering, Sogang University

Biocomposites are widespread in biological systems. Among them, nacre (biogenic aragonite) is one of the most interesting materials, showing 3000 times more fracture resistance and biocompatible properties than abiotic mineral.The organic matrix, which is only a few percent of the composite by weight, is the key to the biomineralization.

The organicmatrix in the mollusk shell is specifically synthesized under genetic control before and sometimes during the biomineralization process. The matrix subdivides the mineralization spaces, acts as a structural framework for mechanical support, and is interfacially active in nucleation. A number of studies have been made to inspect the mechanisms of controlled calcification of the biomineral tissue as applying this delicate control to novel synthetic materials would lead to a promising access to new composites with outstanding properties.

In this study, the calcification of the oyster, *Crassostrea gigas,* which is composed of alternating nanoscale layers of calcium carbonate and organic matrix ismainly focused to get a better understanding of the structural relationship. It is essential to determine the nature of the biogenic nanocomposite and to characterize the organic matrix. Here we discuss in vitro studies of the crystallization of calcium carbonate in the presence of soluble intracrystalline proteins extracted from oyster shell. The results show that these proteins alone are sufficient to control the crystal phase, allowing us to switch abruptly between calcite and aragonite without the need for deposition of an intervening protein sheet. And it could be suggested that having well controlled secondary structures could be the main key to regulating the tissue properties.