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Preparation and fabrication studies of Three Dimensionally ordered gyroid network structure of calcium phosphate crystallites for artificial bone materials

In this study, solution precipitation processes were used in order to synthesize calcium phosphate powder crystallites with nano-macro and meso-scale order. Calcium phosphate [CaP] powders were precipitated by using free-like ions of Ca^{2+} and $\text{H}_{3-x}\text{PO}_4$ from aqueous solution of calcium hydroxide $[\text{Ca}(\text{OH})_2]$ and phosphoric acid $[\text{H}_3\text{PO}_4]$. According to phase boundary in the $\text{CaO-P}_2\text{O}_5$ phase diagram the concentration of Ca_{2+} and $\text{H}_{3-x}\text{PO}_4$ was controlled to make from nano- to macro- scale uniform crystallites. This research goal has been to attain the gyroid geometry in CaP bone blocks. The gyroid geometry was found in butterfly-inspired nanostructure of long-tailed hairstreak butterfly, which can sort light. The green hairstreak butterfly (*Callophrys rubi*) gets its blue-green hue from complex nanoscale structures on its wings. The structures, called gyroids, are repeating patterns of spiral-shaped curls. Light waves bouncing off the patterned surface interfere with one another, amplifying green colors while washing out other shades. We have prepared copolymer template having gyroid chain structure. A polystyrene-*b*-polyisoprene-*b*-polystyrene [SIS] copolymer was synthesized via anionic polymerization. In order to give the gyroid chain structure in CaP bone blocks, triblock copolymers with gyroid chains was prepared through copolymerization (PS-PI/PS) of styrene monomer and isoprene monomer, and used for obtaining gyroid template of CaP nano-crystallites. Isoprene copolymer [PI] in PS-PI/PS gyroid copolymer composites was dissolved in solution and then CaP was infiltrated to get biomimetic gyroid chains in bone. Bone is a metabolic geometry of CaP crystallites and pores, in which bone cell may like to live.

Biography

Myung Chul Chang has completed his PhD at the age of 37 years from Seoul National University and postdoctoral studies from University Illinois at Urbana Champaign. He is the director of Biomaterials Lab. He has published more than 50 papers in reputed journals and has been serving as an editorial board member of repute.

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