

# Synthesis and Characterization of Carbonated Hydroxyapatite and Bio-inspired Polymer-Calcium Phosphate Nanocomposites

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## Abstract

Taking the inspiration from natural bone, where collagen provides sites for the nucleation and growth of carbonated hydroxyapatite, we have developed self-assembling calcium phosphate-block copolymer nanocomposites by using a bottom-up approach. In this regard, self-assembling thermo-reversibly gelling block copolymers based on the nonionic, zwitterionic, anionic, block copolymers conjugated to hydroxyapatite-nucleating peptides, and polylysine-poly-leucine diblock copoly-peptides were employed as templates for the precipitation of nano-sized calcium phosphates from aqueous solutions. Calcium phosphate nanocrystals were formed at the polymer-inorganic interface presumably nucleated by the ionic interactions. Solid-state NMR, XRD, TEM, TGA, FTIR and X-ray scattering techniques were used to characterize the nanocomposites. The findings in our studies provide information for developing guidelines for design of novel HAp-polymer nanocomposites and for the understanding of the mechanism of biomineralization. Moreover, this study may also offer routes for bioinspired bottom-up approaches for the development of a number of nanostructured composites including injectable nanocomposite biomaterials for potential orthopedic applications. As a part of the present study, the carbonate incorporation into the hydroxyapatite lattice under various pH conditions was also investigated. Crystalline sodium and carbonate containing calcium hydroxyapatite (NaCO<sub>3</sub>HAp) powders were prepared using an oxidative decomposition of calcium-EDTA chelates in the sodium phosphate solution with hydrogen peroxide. Furthermore, formation of HAp on PMMA polymer films was also studied by using the same chelate decomposition method. Evolution of HAp coating as a function of experimental variables including time was examined.

## Biography

Yusuf Yusufoglu has been working as a Postdoctoral Researcher at Argonne National Laboratory (Chicago, USA) since October 2009. He received his Ph.D. degree from the Materials Science and Engineering Department of Iowa State University (USA) in August 2009. He completed his undergraduate studies as a double major student at Middle East Technical University in June 2005 and received two degrees from Chemical Engineering and Chemistry Education departments. Yusufoglu's research interests include chemical synthesis and characterization of bioinspired polymer-inorganic nanocomposites, biomaterials and bioceramics. His research has focused upon formation of calcium phosphate inorganic phases on the block copolymers and copolypeptide conjugates acting as a template for the inorganic phase, just like how nature forms bone by mineralizing calcium phosphate on collagen. For this work, he has published five journal articles in addition to one article which is in preparation.