Chemical Engineering Distinguished Young Scholars Seminar

Crystal Therapy: Composite Materials as Next Generation Biomedical Devices

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Date: Monday, July 6, 2015
Time: Lecture: 4:00-5:00 p.m.
Place: PAA A110
Happy Hour in Benson Hall Lobby

Abstract

The development of synthetic biomaterials is a diverse science requiring an interdisciplinary approach involving medicine, chemistry, and engineering. Ideally biomaterials will not only restore lost functionality but also modulate physiological responses. Current materials are prepared from metallic or polymeric materials with an increasing trend towards the formation of robust composite materials. The endowment of biomaterials with properties that can mimic biological systems through the incorporation of proteins, soluble signaling agents, or calcium phosphates (CaPs) are instrumental in the development of materials which can illicit desired physiological responses. This presentation will describe the development of composite biomaterials, which incorporate biologically active crystalline phases. In the first study the incorporation of a metal organic frameworks into polymeric matrices facilitates the catalytic generation of the ubiquitous biosignaling agent nitric oxide (NO) from NO transport agents found in the blood stream. As a result incorporation of catalytic MOFs circumvents the finite therapeutic reservoir that inherently limits current drug eluting materials. Secondarily, we explore the development of polymeric hydrogels that are biomimetically mineralized to contain biologically relevant CaP polymorphs including dicalcium phosphate dihydrate, octacalcium phosphate, and apatite. The CaP polymorphs mineralized in the hydrogel matrix are monitored by X-ray diffraction and can be tuned compositionally and morphologically by adjustments in stoichiometry and reaction pH. Propagating the development of materials for specific applications including use as synthetic bone and dental grafts.

Brief Seminar Synopsis

Development of composite biomaterials with the potential to regulate successful biointegration.

Bio

My principal research interests are in the development of therapeutic materials aimed at improving quality of life for patients experiencing physical disabilities. As a graduate student at Colorado State University my research focused on the development of biomaterials, which incorporated solid-state catalysts into the device matrix for the site specific delivery of biosignaling agents. My current postdoctoral studies at Colorado School of Mines has proceeded down a similar path with the development of biomaterials intended for use in regenerative medicine applications as grafts for mineralized bone and dental tissue.