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Studies of the structures at the surface and in the bulk in biomaterials used in drug delivery and as scaffolds.

Abstract:

Structure determines the performance of materials. Surface structure plays an important role in many areas of materials science from adhesion, corrosion and biological activity. The structure of the material as a whole determines the bulk properties. Results obtained using x-ray scattering for investigating the surface and the bulk structure in biomaterials will be presented. Formation of thin polymer films on aqueous surfaces, and the adsorption of proteins onto polymer surfaces in the aqueous media were investigated using x-ray reflectivity and grazing incidence x-ray diffraction. The idea is to use protein adsorption as a proxy to study response of substrates to biological cells. The study of the bulk structure will be illustrated using the results from the investigation of effect of hydration on polymer properties. The hydration characteristics of biodegradable polymers were investigated using small-angle x-ray and neutron scattering. Hydration leads to phase separation in many polymers used as biomaterials. Consequences of phase separation, one that leads to unusual increase in the modulus of some copolymers, and the other that influences drug delivery when copolymers are used as matrices will be discussed.

Short Bio:

Dr. Murthy is affiliated with the New Jersey Center for Biomaterials. His research deals with the development of materials for biomedical implants, fabrication of devices, and characterization of materials and devices. His research spans a range of activities from understanding the properties and performance of polymers to the use of these polymers in biomedical devices. At a fundamental level, he develops and uses structure-property relationships of polymeric materials using several methods to investigate the structure at molecular to macroscopic length scales. Such studies are useful for example in understanding the influence of hydration characteristics of polymers on their mechanical behavior, biological activity, drug delivery and degradation. Another area of interest is the molecular basis of deformation and failure in polymers, nanocomposites and biological structures. Such fundamental knowledge is used in developing materials and fabrication steps for biomedical applications. He is currently engaged in processing degradable polymers into fibers for use in orthopedic applications, and in the fabrication of these fibers into sleeves, tubes and conduits. A second line of research is the modification of surfaces using non-lithographic techniques for studying call-substrate interactions, and processing of polymers for use as tissue scaffolds in biomedical implants. He is also developing hydrogel technologies for applications where low modulus and high permeability are desirable

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