New functional biomaterials for medicine and healthcare

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This book is an up-to-date introduction to various types of biomaterials increasingly used in medicine and healthcare, ranging from natural and synthetic polymers, inorganic and hybrid polymers, to metallic and bioinert ceramic biomaterials. It comprises eight chapters, each complete with references, and has the advantage of being quite compact (226 pages).

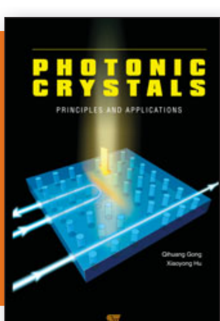
The main trends in biomaterial development and realization are briefly presented with special focus on implantable electronic devices used to demonstrate key aspects and challenges associated with the design of complex implantable systems. An interesting overview on natural polymers, including chitosan, alginate, starch, collagen, and gelatin, is given mainly with respect to bioresorptivity and biodegradability. The advantage of synthetic polymers over biopolymers is demonstrated by their improved chemical resistance, tunability of their properties, and mechanical durability. The drawbacks of organic polymers can be overcome by polymeric biomaterials derived from inorganic and organometallic precursors, which by virtue of their ability for controlled biodegradation are highly suited for medical applications from transient implants to drug delivery vehicles.

Metallic biomaterials remain among the most widely used in medical devices and permanent implants as a result of their special mechanical properties, particularly fracture toughness and fatigue strength. Indeed, the most used metallic biomaterials are based on pure Ti, Ti-Al-V and Co-Cr alloys, and stainless steel, along with novel metallic biomaterials such as bioresorbable Mg alloys and Ni-Ti shape-memory materials. However, such implants can undergo loss of surface integrity followed by leaching of metal ions and particles in the peri-implant surroundings, finally resulting in loss of mechanical function and device failure. In this context the main aspects related to cytotoxicity and biocompatibility are also presented.

Finally, the advanced applications of bioinert ceramic biomaterials, known for their excellent mechanical strength, corrosion, and wear resistance, are described. Their limited ability to be integrated with soft and hard tissues is discussed as a limiting factor for their clinical application. Of special interest are also bioresorbable ceramics, which are actively involved in the metabolic processes of an organism into which they are implanted, since they can mimic the osseous tissue and are able to initiate the biological processes associated with osteogenesis.

The main feature of this book is the strong link between the special properties of these functional biomaterials and their application potential as medical devices. This makes the book interesting for readers coming from both research and industry environments, with expertise in chemistry, physics, materials science, and biomedical engineering.

***Reviewer: Aurelia Meghea** is Emeritus Professor at University Politehnica of Bucharest, Romania.*.



Photonic crystals: Principles and applications

Editors: Qihuang Gong and Xiaoyong Hu

Pan Stanford Publishing, 2013
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This book provides a broad overview of photonic crystals and, as the title suggests, covers their principles and applications. It is written from a physics point of view with an emphasis on materials science. Equations are well explained and often completely avoided in order to increase the readability of the book. The book is divided into eight chapters, starting with a brief introduction. The second chapter deals with different dimensionalities of the photonic crystals and their properties. The third chapter is very interestingly written and provides a survey of the various synthesis methods used for production of photonic crystals, including chemical routes, lithography, and self-assembly of colloidal photonic crystals. Chapters 4–8 constitute the bulk of the book and provide examples of applications of these photonic crystals.

Chapter 4 offers a good explanation of optical switching. Bandgap and defect mode switching are also brought into focus along with many other mechanisms—14 different switching mechanisms in all, including thermal, electro, and magneto switching. Frequency tuning of photonic crystal filters with special attention to nanosize photonic crystals is illustrated, providing a direct perspective on applications of these materials in integrated photonic circuits. The transition from chapter 5 to 6 dealing with photonic crystal lasers is smooth, especially after a clear description of frequency tuning. Here, one- to three-dimensional photonic

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