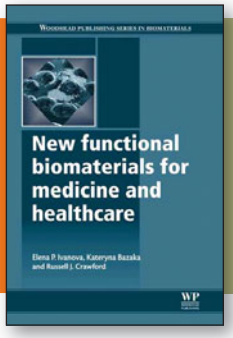


New functional biomaterials for medicine and healthcare

Elena P. Ivanova, Kateryna Bazaka, and Russell J. Crawford

Woodhead Publishing, 2014
226 pages, $200.00
ISBN 978-1-78242-265-5

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).

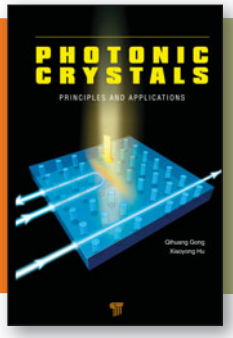
The main trends in biomaterial development and realization are briefly presented with special focus on implantable electronic devices used to demonstrate key aspects and challenges associated with the design of complex implantable systems. An interesting overview on natural polymers, including chitosan, 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
400 pages, $129.95
ISBN 9789814267304

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

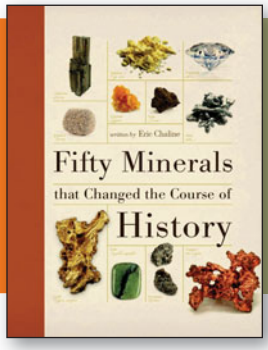
https://doi.org/10.1557/mrs.2014.210 Published online by Cambridge University Press

lasers are explained along with laser oscillations produced by a variety of microcavity methods. Metallodielectric and liquid-crystal photonic lasers are equally well illustrated. Chapter 7 introduces logic devices based on photonic crystals. This chapter clearly explains, with the help of simple illustrations, how to obtain AND, OR, and XOR logic gates. Chapter 8 concludes the book by presenting possible applications, including gas, chemical, fluid, and cell sensing; their workings are very well described from a fundamental point of view.

The diagrams and illustrations are appropriate and eye catching. There are ample references; thus readers are able to find more detailed information to satisfy their curiosity if the book does not suffice.

Even though the introduction provides basics of these photonic crystals, I do get the impression that the bigger picture is missing. A nonexpert may not understand the direct application of such materials right from the beginning of the book. A flowchart or a diagram of these photonic crystals, illustrating applications in daily life at the beginning of the book, could attract a broader readership. In this regard, I believe that this book is most adapted to physicists with a materials science background or vice versa. However, one should take into consideration that the principles of photonic crystals cannot be explained without physics, and therefore the quality of this book remains intact and could very well serve as a textbook for future physicists.

Reviewer: Protima Rauwel *works at the Institute of Physics, University of Tartu, Estonia.*



Fifty minerals that changed the course of history
Eric Chaline

Apple Press, 2013
224 pages, $29.95
ISBN 978-1-84543-507-3

Any chemist would be upset finding steel or ivory in the index of a book devoted to the 50 minerals that changed the course of history. A word of caution is therefore needed, urging a little flexibility and a broader interpretation of the term "mineral" to be generally intended as "something which is neither animal nor vegetable."

This book is part of an appealing project: telling the history of human civilization by focusing on iconic plants (*Fifty plants that changed the course of history*), animals (*Fifty animals that changed the course of history*), and materials (*Fifty minerals that changed the course of history*). The completion of the triad "animal, plant, mineral" is thus the reason for the poetic license that was brought to the title of this book, which is a very enjoyable and informative read.

The text is organized into 50 chapters, naturally, each devoted to a material that played a substantial role in the history of humankind. From alabaster to zinc, the author guides us through the ages, highlighting the importance of each substance for the development of art, culture, science, economy, and technology.

The entries are indexed in alphabetical order by the name that was first used to describe them. The book then starts with diamond (adamas) and ends with zinc. Some schematic information is given on each substance's appearance, source, and chemical formula, with an indication of the reasons (industrial, cultural, commercial, or scientific) for which it deserved citation in this collection of notable minerals. The chapters are short, between two and eight pages, and tell in a compelling anecdotal form how that particular material played a role in history. In-page boxes add to the main text with side stories, curiosities, and notable facts. Elegant and meaningful illustrations embellish and complement the book.

The focus in the text is on history, so the reader should not expect many technical details on the metallurgy of iron or on the radioactivity of radium, but rather a narration of what advancement the discovery of these elements meant for humankind. The author is particularly adept at treating lightly very controversial issues such as the socioeconomic consequences of the exploitation of certain minerals. For example, the chapter on petroleum lightly touches on the future challenge of shifting from petroleum to a more sustainable mix of energy sources, concentrating on the different uses petroleum had across the centuries, from fuel to boiling seawater in the production of salt in ancient China until modern day internal-combustion engines. This distance from divisive contemporary disputes allows the author to adopt a very amusing prose that makes this book suitable for anyone with an interest in science and technology who is seeking some informative enjoyment.

Reviewer: Valerio Causin *works at the University of Padova, Italy.*

https://doi.org/10.1557/mrs.2014.210 Published online by Cambridge University Press