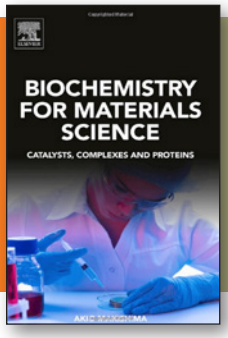


Biochemistry for Materials Science: Catalysts, Complexes and Proteins

Akio Makishima
Elsevier, 2019
329 pages, $150
ISBN 9780128170540 (e-book 9780128168967)

This book provides a comprehensive account of the fundamentals and developments in biochemistry and related materials science topics.

Combining elements of scientific reviews and science communication articles, the book addresses topics with technical accuracy and brevity. The content is introductory and provides references for further reading. Each chapter—and to an extent, each section—is self-sufficient and provides insight into the specific subject or example being discussed. The figures accompanying the text guide the discussion where necessary, such as on NMR spectra, chirality, synthesis schema, and mechanisms. The book does not have worked-out examples or homework problems.

Divided into five parts and 25 chapters, it covers the latest developments in the field (as of 2017), fundamentals of biochemistry, and case studies across disciplines ranging from life science to space.

Part One introduces the reader to recent research that has challenged long-held scientific beliefs. The most notable are compounds formed by helium, which is a noble gas. Noble gases are elements that traditionally have been considered unreactive. Another example is the double helical structure found in inorganic molecules, which is seen mostly in DNA.

Part Two provides a formal introduction to biochemistry. This section discusses monomers and macromolecules (amino acids and proteins, and nucleic acids and DNA), and the structure, natural and chemical synthesis, and purification techniques. For materials scientists, this develops a base to understand the content that follows.

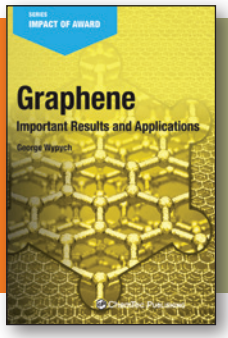
Part Three goes into detail about the use of materials and materials science concepts in biochemistry. Most chapters provide an introductory section to state the fundamentals necessary to understand the content. For instance, the chapter on chirality in space and in the brain starts with a note on chirality before discussing the findings. The discussion on mechanisms in chapters such as bioluminescence and on animal-related topics (specifically, on survival under anoxic conditions) makes the reader appreciate the underlying details.

Part Four discusses biochemistry at the interface of materials science and life science. The accounts of polymers used to increase the stability and thus shelf life of proteins, such as insulin, and use of myoglobin (a protein) as a catalyst for organic synthesis instead of transition metals seed ideas for sustainable innovation.

Part Five offers a mix of discussions on environmental sciences, the origins of life, and water on other planets. From the effects on agriculture because of ocean acidification to the possible hypothesis of the role of alkaline hydrothermal vents in initiating long chain polymerization of biomacromolecules, this section allows the reader to acknowledge the role of biochemistry and materials science across different scales.

The book is directed toward a reader with a background in materials science who wishes to gain an understanding of potential applications and research directions based on fundamentals and techniques of biochemistry. It could be used as a textbook for a senior-undergraduate or graduate-level seminar-like course in either biochemistry or materials science with additional readings from the references. This will enable the students acquainted with the fundamentals to develop a macro-understanding of the subject.

***Reviewer: Somesh Mohapatra**, Massachusetts Institute of Technology, USA.*



Graphene: Important Results and Applications

George Wypych
ChemTec Publishing, 2019
315 pages, $350.00
ISBN 9781927885512

Graphene, which made headlines throughout the scientific world after the 2010 Nobel Prize in Physics announcement, continues to inspire global researchers owing to its performance and multifunctionality. This book investigates the impact of the prestigious award on graphene and related materials research and compiles all major areas of R&D documented thus far related to graphene. The book is divided into nine chapters. The first chapter outlines the pointers to the merits of the Nobel, along with a brief narrative of the book.

The second chapter puts forward an analysis of the publications and patents in graphene research around the globe to showcase the impact the award has made toward the rapid development of graphene technology. Eleven production strategies for graphene, starting from the well-known chemical vapor deposition to nontraditional agricultural waste processing, are discussed as separate sections in Chapter 3.

Chapter 4 presents graphene market analysis, major manufacturers of graphene compounds, and a summary of the properties of commercial products. Chapter 5

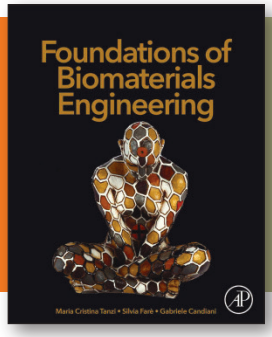
https://doi.org/10.1557/mrs.2020.159 Published online by Cambridge University Press

starts with a detailed morphology analysis of graphene. This is followed by concise sections describing 14 different properties of the multifunctional material, such as mechanical, electrical, magnetic, and thermal properties. Chapter 6 focuses on graphene dispersion processes. Dispersion methods and stability, morphology of graphene-reinforced compounds, spatial configuration, including three-dimensional graphene composites, and impact of dispersion on various properties are analyzed.

Chapter 7 discusses the chemical modification of graphene by different functional groups and the resultant customized applications, various doping techniques, and the properties of doped graphene. Chapter 8 highlights 23 major applications of graphene, which speaks to the huge impact that the material has made. Chapter 9 provides a comparison between the Nobel selection committee justification and the post-award real-world graphene technology by reviewing the materials presented in previous chapters.

This book can be a quick reference guide for graphene researchers at all levels, as well as for those who are interested in staying abreast of the status of graphene when exploring future possibilities. Because the book is a portrait of the developments after the 2010 Nobel Prize, the major share of references span the last decade. Inclusion of these references at the end of each section in all chapters is convenient for quick access. The color photographs throughout the book provide a firsthand grasp of the material presented. Overall, this is a brief, yet adequate, easy to read book covering all aspects of up-to-date graphene research.

Reviewer: Jyothirmayee Aravind S.S.



Foundations of Biomaterials Engineering

Maria Cristina Tanzi, Silvia Farè, and Gabriele Candiani

Academic Press, 2019
572 pages, $99.95 (e-book $97.99)
ISBN 9780081010341 (e-book ISBN 9780128094594)

Biomaterials have made extraordinary advances in the past few decades and have greatly benefited healthcare technologies such as regenerative medicine, drug delivery, and gene therapy. This book is timely in bringing materials science, mechanics, design/manufacturing, and biomedical science all together in a logical and concise manner for an improved understanding of biomaterial properties and engineering techniques. It came about as a result of rich experiences gained by the three authors in the area of industrial bioengineering. It includes extensive illustrations, detailed equations, and rigorous flowcharts to clearly demonstrate the broad applicability of biomaterials for a wide range of healthcare-related applications.

The book is composed of two sections: Section A presents an introduction of materials, and Section B focuses specifically on the properties of biomaterials and their utilities inside the body. This transition allows the reader to first gain an overview of the fundamentals of materials science before delving into biomaterials engineering through a natural flow.

Section A contains three chapters that focus on materials fundamentals. Specifically, Chapter 1 presents the structure and physics of different classes of materials, including metals, ceramics, and composites, with an emphasis on polymers, including a discussion on classification and synthesis of hydrogels. In Chapter 2, a strong analysis is developed on the mechanical properties of materials and biological materials, and includes a discussion of a variety of mechanical tests to assess materials deformation under loading. In Chapter 3, a compact overview of traditional and advanced manufacturing techniques is presented. Some of the emerging techniques in the field of biomaterials fabrication are also discussed.

In Section B, the authors focus on biomaterials and their applications. A wide range of synthetic and natural biomaterials are introduced. Chapter 4 includes a thorough presentation on synthetic polymers, such as polyesters and polyurethanes, as well as natural polymers, including proteins and polysaccharides, followed by metallic, ceramic, and composite materials that are used specifically in biological and biomedical applications.

In Chapter 5, two key unique features of biomaterials and bioimplants—sterility and degradation mechanisms—are presented. Different sterilization techniques are introduced, and this is a key parameter to consider in transitioning biomaterials from benchtop to bedside.

Chapter 6 focuses on the interaction between biomaterials and cells/tissues. Foreign body responses, biofilm formation, and biocompatibility assessment are discussed, followed by characterization and analysis techniques of biomaterials in Chapter 7. A panel of medical imaging techniques, including x-ray-based radiography, magnetic resonance imaging, and ultrasound, are presented in the diagnosis and treatment of diseases.

The authors indicate that this book is primarily written for undergraduates, whereas it is truly a comprehensive and approachable reference for any graduate student or research scientist interested in the topic of biomaterials engineering without prior knowledge. It lays down a solid scientific and engineering foundation for the understanding and future development of the design and manufacturing of biomaterials for biomedical applications and would be of interest to those in materials science, mechanical engineering, biomedical engineering, chemistry, and medicine.

***Reviewer: Jingjie Hu**, Mayo Clinic, USA.*

https://doi.org/10.1557/mrs.2020.159 Published online by Cambridge University Press