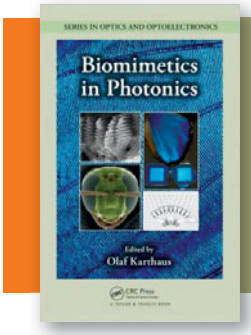
discussed and the fundamental differences between ohmic and quantum conductance are clearly presented. Problems related to carbon nanotube interconnects are explained in order to design devices based on carbon nanotubes and graphene. This chapter gives hints to the reader on how to design electronic devices based on these materials and the problems observed in connecting to the macroscopic world, where the wires are made, in most cases, of copper.

At the end, the important development of a carbon nanotube-based field-effect transistor and its properties are explained. In the last section devoted to applications, nearly all possibilities for technical use in current discussion are explained. Also, the use of carbon nanotubes as a mass sensor with atomic resolution is covered. Fascinating!

In summary, this is an excellent and very complete book on carbon-based nanomaterials and their applications. This book is strongly recommended to everyone interested in the science and applications of carbon nanotubes and graphene, provided the reader has some basic knowledge of solid-state physics. The reader will certainly develop many new ideas for applications.

***Reviewer: Dieter Vollath** is CEO of NanoConsulting, Stutensee, Germany.*



Biomimetics in Photonics
Editor: Olaf Karthaus

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Biological systems display an uncanny inventiveness in adapting to diverse environments available on earth. Given the complexity of living organisms, their adaptations cover a range of topics in engineering, physics, and chemistry, such as mechanics, heat transfer, optics, and electrochemistry. This interesting and illuminating edited volume deals with photonic structures found in plants and animals. It provides an overview of the underlying physical principles which result in the observed photonic structures. The book outlines avenues through which such structures can be adapted for practical engineering applications, such as antireflective coatings, displays, structural colors for textiles, infrared sensors, and night vision enhancement. Numerical approaches for simulating complex structural colors found in nature are also discussed.

This volume is organized into seven chapters contributed by authors with expertise in different areas. Chapter 1 introduces the basic physical principles that enable plant structures such as flowers or leaves to produce or enhance colors by structural adaptations, such as multilayer films and geometrical effects. In Chapter 2, the main biominerals found in nature are discussed along with their optical properties. Optical effects in naturally occurring biominerals such as mother-of-pearl, the cell walls of diatoms, and the spicules of sponges are presented. This chapter also outlines possible approaches for replicating naturally occurring structures for photonic engineering applications. Chapter 3 contains a fascinating discussion of several aspects of photonic structures found in nature—the antireflective properties of moth eyes, metallic reflection in beetles and fish, and narrow-band and wide-angle color reflection in the *Morpho* butterfly wings. The roles of nanostructure and randomness in narrow-band reflection from the *Morpho* butterfly wings are given particular attention and makes for very interesting reading.

Chapter 4 introduces the extraordinary infrared (IR) detection capability of the *Melanophila* beetle, which can detect IR heat fluxes in the range of 4×10^{-5} W/m^2 to 3×10^{-4} W/m^2, and models the mechanism with a Golay cell detector. Chapter 5 outlines possible approaches for industrial scale production of one- and three-dimensional photonic structures with tunable colors as well as moth-eye–based anti-reflection films. Chapter 6 covers the basic principles underlying enhanced night vision in nocturnal animals such as the *Megalopta genalis* (nocturnal bee). The principles are then extended to develop algorithms to enhance image processing for monochromatic and color video images. Chapter 7 discusses and applies the underlying theory of Finite-Difference Time-Domain numerical approaches to simulate the structural colors found in the *Morpho* butterfly wings.

In summary, this volume is written in an accessible fashion and is a useful introduction to the field of biomimetics for photonic applications.

***Reviewer: Nirmal Govindaraju** is a Research Assistant Professor in the School of Materials Science and Engineering at Oklahoma State University, USA.*

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