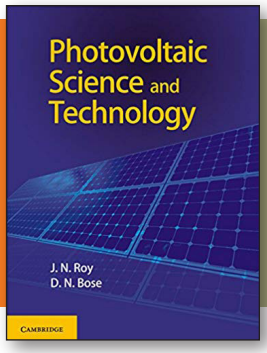


Photovoltaic Science and Technology

J.N. Roy and D.N. Bose

Cambridge University Press, 2018
440 pages, $105.00 (e-book $84.00)
ISBN: 9781108415248

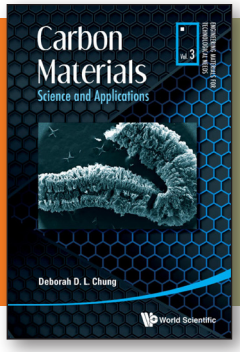
This book provides a comprehensive description of photovoltaic (PV) technology, presenting the fundamental concepts for solar energy, types of solar cells, solar PV (SPV) modules, and SPV systems, which makes it a useful reference text in this field. The chapters are well written, illustrated, and organized, and the end of each chapter includes a summary and a list of homework problems.

The book begins by discussing solar energy and photovoltaics, first with a general presentation on solar-energy-conversion principles and semiconductor properties, and subsequently describing solar cells and their efficiency. Chapters 2–5 address the different types of solar cells: crystalline silicon cells, thin-film solar cells, III–V semiconductor solar cells, and organic and polymer solar cells. These chapters explain the synthesis and properties of the materials, operation, efficiency, and applications of each type of solar cell.

The focus of chapter 6 is upon manufacturing technology of the main types of solar cells, such as the baseline processes of crystalline silicon cells and III–V semiconductor-based cell technology. Chapter 7 explains the manufacturing of solar PV modules. The description of the characterization techniques used during SPV module manufacturing continues throughout chapter 8. Chapter 9 introduces SPV systems, covering topics such as solar inverters and power conditioning units, classification of SPV systems, energy production, and the economic viability of these systems. The book concludes with a chapter devoted to the design and implementation of off-grid and on-grid SPV systems.

This book is an excellent choice for an introductory course in PV technology for graduate and undergraduate students. It is also a good reference for scientists and engineers working in this area. Overall, it provides a good overview of fundamental concepts, principles, and applications of photovoltaic devices and systems, including an extensive list of relevant and updated references.

***Reviewer: Mariana Amorim Fraga**, visiting professor at the Universidade Federal de São Paulo, Brazil.*



Carbon Materials: Science and Applications

Deborah D.L. Chung

World Scientific Publishing Company, 2019
384 pages, $48 (paperback)
ISBN: 9789811200939

This book covers the many different forms and applications of carbon materials. Chapter 1 provides introductory content on carbon materials, namely the diamond family, the graphite family, and the fullerene family. All of these forms differ in structure, properties, applications, and fabrication methods.

The main body of the book (chapters 2–7) covers graphite, graphene, carbon black, activated carbon, carbon fibers, and carbon nanofibers (CNFs) and nanotubes. In chapter 2, graphite is described as the largest family and consists of graphite, turbostratic carbon, intercalated graphite, graphite oxide, exfoliated graphite, flexible graphite, graphene, activated carbon, carbon black, and carbon-carbon composites. Graphite is used in electrical and medical applications. Pyrolytic graphite has highly oriented layers of graphite in contrast to polycrystalline graphite. Magnetic and electrical properties are discussed along with different compounds and intercalation compounds.

Chapter 3 on graphene describes a single or small number of layers of three-dimensional graphite. The small size of graphene along with its excellent electronic, mechanical, and antimicrobial properties allows it to be used in many applications, such as sensor electrodes, biosensors, tissue engineering scaffolds, bioimaging agents, and drug delivery carriers. Activated carbon is a partially crystalline form of graphite consisting of amorphous carbon in the form of turbostratic carbon interconnecting graphitic regions.

Chapter 4 on carbon black talks about a low-cost material made by the incomplete combustion of heavy petroleum products. Carbon black is a compressible nanoparticle used as a thermal interface material to increase electrical conduction in batteries and supercapacitors, to improve the strength and abrasion resistance of rubber, and as a pigment for paints and inks.

Chapter 5 on activated carbon describes a partially graphitic and amorphous material in which various surface treatments are used to increase the pore area and properties of the material. Water and air purification, carbon dioxide capture, electrochemical devices, and catalyst support are among the many uses of activated carbon.

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Chapter 6 on carbon fibers covers the synthesis and application of continuous carbon microfibers with high strength, high elastic modulus, and low density that are mainly used as a reinforcement material in polymer composites. Carbon fibers are anisotropic and have high strength, electrical and thermal conductivity, and high modulus in the fiber axis compared to the transverse direction. The Boeing 787 aircraft contains approximately 77,000 pounds of carbon fiber-reinforced plastic. Carbon fiber composites are compared to composites made using other types of fibers in terms of specific strength and specific stiffness.

Chapter 7 on CNFs and nanotubes describes graphitic carbon tubes that have high strength and other important properties. CNFs and carbon nanotubes (CNTs) can be formed into mats or yarn held together by van der Waals forces. CNTs can also be grown on carbon fibers, carbon black, graphene, alumina, silica fibers, exfoliated graphite, reduced graphene oxide, and metals. CNTs have high thermal conductivity, a high modulus of elasticity, and high tensile strength and find applications in many engineering fields.

The field of carbon materials is huge and often difficult to comprehend, but this book is easy to read and methodically covers the subject, including presenting materials properties and performance data with clear illustrations and graphs. References include relevant older and up-to-date sources of information. The book is tutorial style in nature and is an excellent resource for senior undergraduates, graduate students, researchers, and anyone who wants to learn more about carbon and incorporate carbon materials into new applications.

***Reviewers: Anuptha Pujari and Mark Schulz**, the University of Cincinnati Nanoworld Laboratories, USA.*

Addendum: In the interest of transparency, MRS is a co-publisher of the book *Materials Engineering: Bonding, Structure, and Structure-Property Relationships*, which was reviewed in the June 2019 issue of *MRS Bulletin*. The review was requested and reviewed by an independent Book Review Board.

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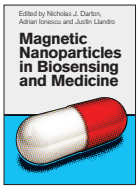

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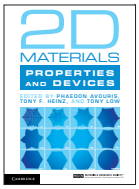

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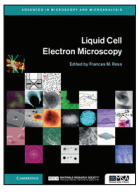

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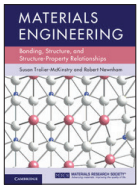

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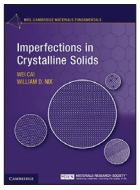

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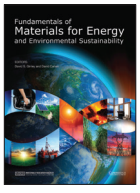

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