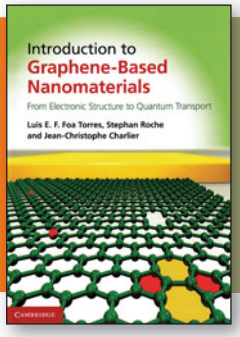


Introduction to Graphene-Based Nanomaterials: From Electronic Structure to Quantum Transport

Luis E.F. Foa Torres, Stephan Roche, and Jean-Christophe Charlier

Cambridge University Press, 2014
419 pages, $90.00
ISBN 978-1-107-03083-1

Graphene is a single layer of carbon and may be considered as one layer of the graphite structures. Nowadays, besides monolayer graphene, bi- or multilayer varieties are also well known. These two-dimensional objects curl up to form carbon nanotubes. Graphene and carbon nanotubes comprise a new class of materials that are scientifically and technologically of extreme importance. This book deals with solid-state physics applied to this class of materials, ranging, as mentioned in the subtitle, from "electronic structure to quantum transport." The content and structure of this book make it necessary that the reader has an advanced knowledge of theoretical solid-state physics.

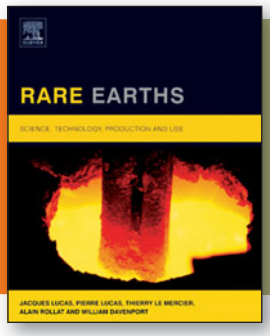
The book is divided into seven chapters plus four chapters in the appendix. Each chapter starts with a short introduction and ends with suggestions for further reading. Additionally, at the end of each chapter, typical for a textbook to be used in parallel to university lectures, problems are included.

The book begins with a description of the electronic structure. Interestingly, the authors describe not only the "idealized" structure, but also the occurrence of lattice defects, pentagons, and heptagons, instead of hexagons, which are the basis of the graphene structure. The influence of these lattice defects and impurities on the electronic structure and transport properties is described in great detail. Unfortunately, these considerations were not extended to mechanical properties, as polymer composites with graphene or carbon nanotubes as filler show extremely promising mechanical properties. The majority of the book is devoted to quantum transport phenomena. These phenomena are treated in different systems, well ordered and disordered ones; doped and undoped graphene and carbon nanotubes; and, what is most interesting and very new, electron transport in amorphous graphene.

The final four chapters in the appendix describe mathematical methods to perform the calculations in connection with electronic structure and transport phenomena connected to graphene and related materials. It is important to mention that the authors make the computational codes available for readers at their homepages. As is necessary for an excellent book in sciences, there is a long list of a few hundred references at the end of the book. Even though the list of keywords at the end of the book is really long, it was obviously unavoidable to have many different references (up to ca. 70) for one keyword.

If a student or scientist already has basic theoretical knowledge, this is an excellent book for those interested in this special carbon-based material.

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



Rare Earths: Science, Technology, Production and Use

Jacques Lucas, Pierre Lucas, Thierry Le Mercier, Alain Rollat, and William Davenport

Elsevier, 2014
407 pages, $174.25
ISBN 978-0-444-62735-3

Rare earths have been widely discussed in the popular press and at conferences because of their strategic importance, especially in clean energy technologies, but a reliable source of information that can raise the level of debates has been missing. This book fills the void. By a careful selection of topics, it meets its stated objective of describing the state of the art as of early 2014 on rare-earths occurrence, extraction, atomic structure, technology, applications, use, and recycling.

The first two chapters give an overview of the importance of rare earths, and data on production, use, and price, as well as volatility. Ores containing bastnäsite, monazite, and xenotime minerals and cation adsorption clays are industrially important. The ways these are processed to obtain usable forms such as oxides and metals are described in chapters 3–7. A special feature is the number of flow sheets and photographs the authors have thoughtfully provided in addition to equations.

The electronic structure of rare earths is an important topic (covered in chapter 8), and the 4*f* electron configuration determines their properties, including magnetic and optical behavior, as explained subsequently. Chapters 9–17 discuss applications in catalysis (ceria with platinum group metals), batteries (lanthanum, cerium, praseodymium, neodymium-nickel in cathodes), alloys (e.g., cast iron, magnesium), magnets (iron-neodymium-boron and samarium-cobalt), glass polishing (ceria), luminescent materials in fluorescent lamps (lanthanum, yttrium, cerium, europium, and terbium), optical-fiber amplifiers (erbium) and medical sensors (gadolinium, cerium, lutetium, and terbium), and lasers (ytterbium and neodymium). In each case, the underlying principles are discussed. The recycling techniques developed for materials used as above are discussed next. The

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