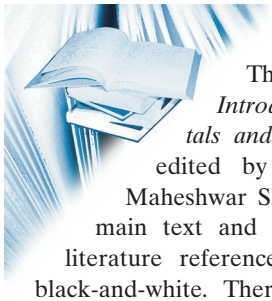


Graphene

The book *Graphene: An Introduction to the Fundamentals and Industrial Applications*, edited by Madhuri Sharon and Maheshwar Sharon, has 255 pages of main text and an appendix containing literature references, and is produced in black-and-white. There are currently several other books with similar titles, but they differ in content and scientific depth. Some books focus more on basic research, others more on applications, and consequently the reader cannot evaluate their particular relevance from the title alone. The strength of this book is its relevance to industrial interests, and it includes a discussion of challenges for developing applications of graphene. The reader gets a good impression of the types of applications that are currently being considered. The book includes a well-organized summary of companies that already produce graphene-based materials, are developing applications based on graphene, and provide equipment or services. It also covers mining companies that supply graphite.

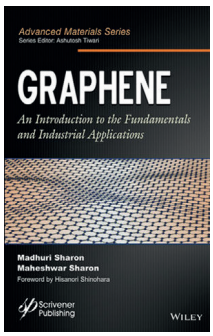
The book begins with a very interesting chapter on the history of graphite, which extends back to the sixteenth century. The key events that led to the discovery of the physical properties of single layers of graphene are well described. The research field of graphene is introduced in the following chapters. It becomes clear that graphene can be seen as the mother of other carbon allotropes. Also methods for the synthesis of nanographene are described, and its physical properties are summarized. However, chemists concerned with synthesis will be disappointed that there is no complete description of the exact chemical structures, and that some chemical structure diagrams are of poor quality. Anyone expecting physical formulas for quantifying the effects and properties of graphene will also be disappointed. Instead, some known properties of graphene are only summarized briefly, and unfortunately other sections merely repeat these summaries. Also, the text follows a very rigid structure, which results in some chapters being as short as only four lines. The information provided in such small chapters is consequently low, especially because they often lack references.

It is not possible to summarize the whole subject of graphite-related particles in a generalized way, and consequently the more detailed description of materials and their characterization in the later chapters appears disorganized and confusing, and seems to be arbitrary in some places. The reader will have to search in specialized literature to find that information. The field of graphene chemistry and the characterization of the properties of graphene is expanding rapidly, due to many national and European initiatives in that field of research, such as the "Graphene Flagship" that coordinates research in Europe. Therefore, the book runs into the problem that the results described are sometimes already obsolete, due to the continuing rapid increase in basic knowledge.

Furthermore, the reader should be aware that the terminology used to describe the graphene-based materials is not accurate throughout the book, just as it also lacked clarity in the primary literature some years ago. Consequently, the term graphene is applied to any kind of processed graphite, rather than being strictly reserved to single atomic layers of carbon with a honeycomb lattice. Also, powders of exfoliated graphite and few-layered aggregates of graphene are called graphene. Moreover, reduced graphene oxide is described simply as reduced graphene.

Raman spectroscopy is an analytical tool that has developed rapidly in recent years, and that has made it possible to reliably evaluate the quality of graphene. This topic is outlined only briefly, and therefore the reader must rely on other literature. The publications of Ferrari, Cançado, and Lucchese et al. should have been mentioned as helping the reader to understand differences in the quality of graphene. In general, characterization techniques and the interpretation of spectra have developed a lot, and the information given in this book should be treated with caution. However, it is a starting point.

The strength of the book is found in the last chapters, where the needs of industry and end-user markets are discussed. There is a huge amount of graphene business based on growing layers of graphene on catalytically active metal substrates by chemical vapor deposition. However, the graphene grown in that way must be transferred to other surfaces such as transparent substrates. Therefore, the authors describe the challenges and advances of that transfer process in detail in a separate section. Finally, the economics and estimated value of the "graphene market" are introduced, and the book ends with a discussion of future graphene-based applications, such as graphene drones or graphene-based speakers for audio systems.



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