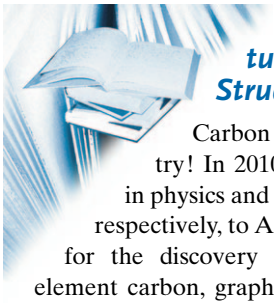


Carbon Nanotubes and Related Structures

Carbon is fashionable in chemistry! In 2010 the latest Nobel Prizes in physics and chemistry were awarded, respectively, to A. Geim and K. Novoselov for the discovery of a new form of the element carbon, graphene, and to R. H. Heck, E. Negishi, and A. Suzuki for the discovery of the palladium-catalyzed cross-coupling reactions that generate carbon–carbon bonds. These recent Nobel awards come to join that obtained in 1996 by H. Kroto, R. Smalley, and R. Curl for the discovery of fullerenes 25 years ago.

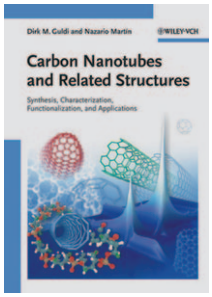
In this connection, carbon nanotubes (CNTs), another carbon allotrope, have attracted the attention of the scientific community since the discovery of multi-walled CNTs by S. Iijima in 1991 and, two years later, of single-walled CNTs (SWNTs) by Iijima and Ichihashi (NEC Corporation) and Bethune et al. (IBM). These findings paved the way for the study of this new monodimensional form of carbon, with unique and unprecedented physical, mechanical, and chemical properties, which raised huge expectations among scientists. As a result, a variety of excellent books on carbon nanotubes have appeared over a period of nearly two decades. However, scientific progress in this area of research is so rapid that the latest results need to be collected periodically in journal reviews and books that update the current state of knowledge in this highly competitive field.

It is in this context that this new book edited by two leaders in the study of new carbon allotropes, Dirk M. Guldi and Nazario Martín, now appears. Whereas the first editor's research is focused on the photophysics of the broad scope of carbon-based systems, the second editor is widely recognized for his expertise in the chemical modification of the different nanoforms of carbon and the development of new reactions for these allotropes.

This book of over 500 pages contains 16 different chapters with little or no overlapping, which have been rationally organized in three main parts. The first part is concerned with the production, electronic and electrochemical properties, theory, and chemical reactivity of CNTs. That is followed in the second part by a series of chapters devoted to applications of CNTs in different areas involving both biological aspects and materials science. The third part consists of chapters dealing with related carbon nanostructures other than CNTs, namely the lesser-known carbon nanohorns, nanographenes, and endohedral fullerenes. The book ends with a chapter devoted to calculations on the energetics, thermodynamics, and stability of CNTs. Most chapters end with a summarizing conclusion that also serves as an abstract. The combined authors of the chapters give a good representation of the area. The list of authors includes most (but not all) of the leading researchers in the chemistry and physics of carbon nanotubes.

In the first chapter, Rümmeli, Ayala, and Pichler discuss the production and formation of CNTs. They show that the length variation, control of the concentration of defects, and the chirality variation of thick nanotubes are crucial parameters for obtaining monodisperse samples with full control of length, chirality, and diameter. Chapter 2, by Rodkin and Snyder, deals with the theory of electronic and optical properties of DNA–SWNT hybrids. In this interesting chapter the authors present new insights into these recently discovered hybrid structures of single-stranded DNA and SWNTs, and discuss the influence of the charged DNA wrap on the electronic and optical properties of the SWNTs. That introductory part is followed by two comprehensive chapters, Chapter 3 on electrochemistry (Iurlo, Marcaccio, and Paolucci) and Chapter 4 on the photophysics of CNT-based materials. Breakthroughs in the chemistry of CNTs are covered by two excellent contributions, Chapters 5 and 6, the former one focused on noncovalent functionalization of CNTs (Herranz and Martín), and the second one, which is meticulously referenced, on covalent functionalization (Hauke and Hirsch). Both chapters review the synthetic methodologies that have been used so far for the preparation of CNT-based covalent and supramolecular systems, and are fundamental for the application of CNTs in materials science, biology, and medicine.

In the second part, Chapter 7 is devoted to the application of carbon-based nanomaterials in biomedicine (Singh, da Ros, Kostarelos, Prato, and Bianco). This is a nicely written chapter describing the medical applications of different kinds of CNT-based nanomaterials, with a discussion of biocompatibility and toxicity. The implications of charge transfer between the ground and excited states of CNTs are discussed in detail by Sgobba and Guldi in Chapter 8. That chapter is well complemented by Chapter 9, which deals with the integration of CNTs into organic photovoltaic cell devices (Kymakis). In Chapter 10, Shim and Kotov describe layer-by-layer assembly of multifunctional CNT thin films, a technology that offers an interesting possibility for controlling the structure of composite materials on a nanometer scale. This part is completed by Chapters 11 and 12, which discuss fundamental issues related to the use of CNTs for catalytic applications (Castillejos and Serp) and the potential of CNTs to serve as nano-containers for a wide range of compounds (Chamberlain, Giménez-López, and Khlobystov).



Carbon Nanotubes and Related Structures
Synthesis, Characterization, Functionalization, and Applications. Edited by Dirk M. Guldi and Nazario Martín. Wiley-VCH, Weinheim 2010. 540 S., hardcover, € 149.00.—ISBN 978-3527324064

The third and last part of the book is devoted to carbon nanostructures other than CNTs, which are receiving a great deal of attention. Thus, in Chapter 13 Yudasaka and Iijima outline the production, structure, chemical functionalization, and potential applications of carbon nanohorns (SWNHs). Next, the self-organization of nanographenes is treated very nicely in Chapter 14 by Pisula, Feng, and Müllen. The authors point out that the self-assembly in individual nanostructures of functionalized nanoscale graphenes paves the way for novel device applications on a molecular scale. Chapter 15 completes this third part by describing the chemistry of the fascinating endohedral metallofullerenes (Feng, Akasaka, and Nagase). The final chapter is focused on the energetics, thermodynamics, and stability of carbon nanostructures (Slanina, Uhlik, Lee, Akasaka, and Nagase).

In summary, I feel that this is a timely book covering most of the aspects of interest on CNTs. The book is well written in general, although with different styles as is often the case in multi-author books. However, common to all chapters is the clear presentation of a particular aspect of CNTs and their related structures. A little criticism: although the book contains an extensive collection of literature references in the chapters, with the most recent ones from 2009, in some chapters there are no citations later than 2008. More attention should have been devoted to updating the references in all the chapters.

Nevertheless, this is an important book in which the editors have provided an outstanding service by bringing together some of the most important scientists in the important field of CNTs. This is an excellent book, which is essential for the personal libraries of all scientists engaged in this area of research, but is also of interest to non-experts who would like to read about the most important advances in CNTs and other related structures in a single volume. I do not hesitate to recommend this book to our colleagues, and in general to everybody interested in the nanoforms of one of the most fashionable elements, carbon.

Tomás Torres
Universidad Autónoma de Madrid and IMDEA Nanoscience
Cantoblanco, Madrid (Spain)

DOI: 10.1002/anie.201006930

