

Book Review of Fullerenes: Nanochemistry, Nanomagnetism, Nanomedicine, Nanophotonics

Fullerenes: Nanochemistry, Nanomagnetism, Nanomedicine, Nanophotonics. By Elena Sheka (Peoples' Friendship University of the Russian Federation, Moscow, Russia). CRC Press (an imprint of Taylor & Francis Group): Boca Raton, FL. 2011. xvi + 312 pp. \$139.95. ISBN 978-1-4398-0642-5.

This book covers a range of topics in the field of fullerene chemistry from physical properties to medical applications and photonic characteristics. Sheka's approach to the topics is primarily computational in nature, but some comparisons are made to experimental observations. The book provides the fundamental background for computational science research of complex fullerene derivatives.

In Chapters 1–3, Sheka discusses computational approaches to fullerene C_{60} and its derivatives, subjects that showcase the author's expertise. These are followed by three chapters under the overarching and somewhat misleading title, "Nanochemistry of fullerene C_{60} ", and respective subtitles concerning the chemistry of fluorination, hydrogenation, and cyano/azo derivatives. The coverage represents only a very narrow range of the chemistry known to date for functionalizing fullerenes.

Chapter 7, "Nanochemistry of fullerene C_{60} : Donor–acceptor reactions of fullerene C_{60} with amines", concerns the photo-induced intermolecular electron-transfer phenomena of C_{60} in the presence of the donor. Only limited and simple cases are presented from the large number of C_{60} -chromophore and supramolecular configurations studied to date. Normally, this area of study is not regarded as fullerene nanochemistry and the chapter could have been more appropriately titled, "Photophysical Electron/Energy Transfer Phenomena upon Photoexcitation", for example.

The focus of the next chapter is on various computational analyses of dimerization and oligomerization of fullerene C_{60} , followed by Chapter 9, "Nanomedicine of C_{60} ", on solubilized forms of the molecule. However, current interest in medical applications of fullerene C_{60} is focused on highly water-soluble fullerene derivatives rather than solubilized forms in order to minimize the potential cytotoxicity and safety concerns associated with nanomaterials. It would have been useful for the author to discuss such derivatives as well.

Chapter 10 covers the photonic properties in terms of optical absorption and emission spectra of C_{60} and some monoadducts in cluster form giving localized charge-transfer excitons. It could have been combined with Chapter 7 since the photoexcitation transitions and triplet energy- or electron-transfer events to molecular oxygen are identical, with the exception that the presence of a donor is considered in Chapter 7, but not in Chapter 10. The application of C_{60} in photodynamic therapy that is described in the latter part of Chapter 10 requires major modification of the functionality of the molecule so that formation of clusters can be minimized to reduce potential self-quenching and triplet annihilation in cluster aggregates as well as to possibly enhance drug delivery

and targeting strategy. Because this aspect is not discussed, this part of the chapter is less useful than it might have been.

In later chapters, similar computational chemistry was applied toward the simulation of nanotubes and graphenes of interest in order to give insight into the differences in chemical reactivity—which is much higher for fullerenes—and physical properties among these forms of carbon. In terms of the magnetism of these materials, the author needed to point out more clearly its existence only in the oligomerized form of C_{60} and the significance of its magnitude. In conclusion, the book would be most suitable for readers interested in computational science and in basic pristine carbon materials.

Long Chiang

University of Massachusetts Lowell

10.1021/ja207059m

Published: August 29, 2011