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BOOK REVIEW

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Book Review of Chemistry of Discotic Liquid Crystals: From Monomers to Polymers

Chemistry of Discotic Liquid Crystals: From Monomers to Polymers. By Sandeep Kumar (Raman Research Institute, Bangalore, India). CRC Press (an imprint of Taylor & Francis Group): Boca Raton, FL. 2011. xvi + 502 pp. $189.95. ISBN 978-1-4398-1143-6.

This reference book is a timely contribution to the chemistry of discotic liquid crystals (DLCs), 34 years after the first DLCs were reported. In contrast to the majority of books on liquid crystals, this volume focuses on the synthesis and molecular structure of DLCs. More than 3000 different discotic derivatives are described within the limits of 500 pages and 6 chapters, which is a formidable achievement.

Chapter 1 begins with a brief general introduction to liquid crystals, followed by a comprehensive description of DLCs and their reported mesophases. The final section is entirely dedicated to their alignment. Good alignment of anisotropic discotic mesophases is crucial for virtually all their applications and a present obstacle to their development. This section provides the most comprehensive review of alignment techniques to date, although some important recent contributions by Grelet/Bock and Armstrong are not included. Subsections are dedicated to the industrially implemented alignment of the nematic discotic mesophase, the planar and homeotropic alignment of discotic columnar mesophases that is essential to their use in electronic devices, and the alignment of DLCs in meso- and macroporous inorganic materials. The multitudes of experimental observations reported in the literature are successfully merged, but the author does not attempt a comparative discussion of the compiled experimental results.

At 280 pages, Chapter 2 is the longest by far and covers the ubiquitous monomeric DLCs. Sections organized by the discotic core structure make the vast number of different compounds readily accessible. This type of categorization is particularly appealing to synthetic chemists and is ideal for everyone searching for DLCs based on specific classes of compounds, such as triphenylenes, porphyrins, phthalocyanines, truxenes, and tricycloquinazolines. Less common monomeric discotic core structures are collected in sections on miscellaneous discotic metallomesogens, heterocyclic cores, and nonaromatic cores. Sections that cover common discotic cores have several subsections based on differences in substitution patterns, which is an established categorization for DLCs. The occasional separation of carbocyclic and related heterocyclic core structures is less intuitive, e.g., Sections 2.10 for truxenes and 2.18 for heterotruxenes (oxatruxenes, thiatruxenes, and triindoles), but all discussed core structures are listed in the otherwise limited index. Chapters 3−5 on oligomeric and polymeric DLCs are structured similarly to Chapter 2 but offer an additional and useful categorization based on the number of linked discotic cores, starting with a chapter on dimers. Trimers to heptamers are dealt with in Chapter 4, and polymers in Chapter 5.

Individual classes of compounds are introduced by reaction schemes throughout Chapters 2−5, with 188 schemes for Chapter 2 alone. This visual approach invites readers to page through the volume and be inspired by the diversity of molecular structures and synthetic pathways. Yields are omitted from schemes but occasionally mentioned in the text, which focuses on the synthetic procedures and liquid crystal properties. Other noteworthy properties are also reported, including charge carrier mobility, frontier orbital energies, and toxicity. Phase transition temperatures of all described compounds are provided in tables that include references. The discussion of each set of compounds is necessarily terse but effectively summarizes the most relevant information. This approach caters to those who are familiar with the basic concepts of DLCs but requires less experienced readers to frequently consult relevant introductory sections of Chapters 1 and 6 and the primary literature.

Chapter 6 concludes with industrially relevant optical and semiconductor properties of DLCs. Both sections provide a good overview of the state of the art, although in the subsections on charge carrier mobility, the author only describes results obtained by the two most common methods of measurement. Mobility values obtained with field-effect transistor devices and space-charge limited current techniques are occasionally mentioned in the text but are not included in the tables. In a third section, Kumar describes the often-disregarded carbonaceous mesophases that are closely related to DLCs. This important section is somewhat isolated in Chapter 6 and might have been better situated in Chapter 1.

References of Chapters 2−5 are combined in one list at the end of Chapter 5, whereas Chapters 1 and 6 have separate lists of references. All references are listed according to their appearance in the text and do not include titles. Most review articles are included but are not specifically highlighted in the text or in the references. Overall, the search options are surprisingly limited for a reference book such as this. Finding contributions by a specific author, for example, is time-consuming because no author index is provided, and equally challenging is a search for compounds that form a specific mesophase. Key references on some topics can be found in the introductory sections and subsections of Chapters 1 and 6, but readers who prefer more search options may want to consider the available e-book instead of a hardcopy.

Kumar's book will be a key resource and a "must buy" for all researchers involved in the synthesis and investigation of DLCs, because it combines information scattered over dozens of review articles in a single and concise volume. It will also aid those who cover DLCs in undergraduate and graduate courses by easing their search for key references on specific concepts of DLCs and discotic compounds. Unfortunately, there are a number of typos and minor mistakes in both the text and schemes that will hopefully be removed in the next edition.

S. Holger Eichhorn
University of Windsor

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