BOOK REVIEWS

NMR of liquid crystal dendrimers, by Carlos Rodrigues da Cruz, João L. Figueirinhas and Pedro J. Sebastião, Singapore, Pan Stanford Publishing Pte. Ltd., 2017, 248 pp. (6 Colour & 65 B/W Illustrations), £95 ($130, 110 Euro) (hardback), ISBN: 9789814745727

The book entitled NMR of Liquid Crystal Dendrimers deals with recent nuclear magnetic resonance (NMR) studies performed on a peculiar kind of soft materials: the liquid crystalline dendrimers. The three authors from the University of Lisbon (Portugal) are recognised experts in the field of NMR of liquid crystals. The book is intended to be useful for researchers and graduate students approaching the field of NMR of soft materials and, in particular, the world of liquid crystalline dendrimers. Dendrimers are very fascinating materials with a hyper-branched structure, produced and characterised for the first time about 20 years ago, which attracted the interest of the liquid crystalline community due to their potential technological applications. Dendrimers present combined properties of branched polymers, but they have a very high mono-dispersion and average dimensions in the nano-scale.

The book is divided into nine chapters, the first one representing a sort of introduction of the book with a very short description of what dendrimers are, followed by a justification of the book chapters’ structure. Chapter 2 is entitled ‘Liquid Crystals’ and it has the aim to introduce the readers in the field of this kind of state of matter, with a presentation of the rich variety of molecular structures and shapes, from the most common rod-like and disc-like shapes to the more exotic bowlic- and pyramidal-like ones. This part is followed by the description of three mesophases typically found in thermotropic liquid crystals: the nematic, the smectic and the columnar phases. Details are given mainly about the structural organisation and the elastic properties of these mesophases. Optical properties and calorimetric features are not treated.

Chapter 3 introduces the readers in the core of the book, describing in great detail all kinds of liquid crystalline dendrimers: side-chain, main-chain and shape-persistent liquid crystal dendrimers. Their chemical structure, molecular and supramolecular organisation is discussed here with several well-chosen illustrative examples. Chapter 4, entitled ‘Fundamentals of Nuclear Magnetic Resonance’, is a sort of condensed CliffsNotes of a book on NMR principles, from the definition of the nuclear spin to the dynamic evolution of the density matrix describing a general spin system. This part is very useful to introduce the next chapter, number 5, which focuses on the NMR (theory and experiment) used to study anisotropic fluids, such as liquid crystals. Chapter 5 contains a high level of formalism with the purpose to derive theoretically the NMR spectra of selected spin systems by using two main NMR experiments: the single pulse and the solid echo pulse sequences. Few details about the experimental NMR set-ups are given at the end of the chapter.

If the structural and orientational properties of anisotropic materials can be achieved by using the NMR methods as described in Chapter 5, the study of the dynamic behaviour of anisotropic systems needs different NMR tools. Chapter 6 and Chapter 7 aim to cover this topic. The authors decided to divide the study of dynamic motions by NMR into two chapters: the theory is reported in Chapter 6 and a selection of all possible NMR experiments is reported in Chapter 7. Both parts are mainly focused on $^1$H NMR relaxation methods and on the theories developed to extract dynamic information from nuclear magnetic relaxation dispersions. The applications and the studies of liquid crystalline dendrimers based on NMR spectroscopy are reported in the two conclusive chapters.

Both chapters discuss several case histories derived from their own research. Chapter 8 is centred on the study of phase biaxiality, which is still a quite hot topic in the liquid crystalline field, of several organosiloxane tetrapodes by means of $^2$H NMR spectroscopy. After a brief introduction of the quadrupolar features of the $^2$H nucleus, the authors report both the experimental procedures and the spectral simulation developed to address the key-issue of phase biaxiality in the nematic phases formed by liquid crystalline dendrimers. This part is discussed in detail, and compared with other cases in...
the literature. The last chapter, Chapter 9, reports a sequence of cases studied by the authors concerning the dynamics of liquid crystalline dendrimers. The first case is about end-on organosiloxane tetrapodes with strong terminal dipoles showing smectic A and smectic C phases. \(^1\)H NMR relaxometry resulted to be very useful to study the layer undulation motion, while in the case of organosiloxane octapodes with lateral mesogens, this technique allowed a good characterisation of re-orientational motions and columnar deformations. The chapter ends with the case of several polyamidoamine liquid crystalline dendrimers. A quite complete bibliography concludes the book.

_NMR of Liquid Crystal Dendrimers_ is a well-written book. The scheme of the chapter is clear, and repetition of concepts is carefully avoided. Figures are almost all in black and white; probably the presence of colours would have increased the quality of the book. The book provides a very good overview of the field of liquid crystalline dendrimers studied by NMR and it can be of interest for researchers and graduate students aiming to deepen both experimental and theoretical aspects of NMR spectroscopy applied to the investigation of the fascinating liquid crystalline dendrimers.

Valentina Domenici  
_Dipartimento di Chimica e Chimica Industriale, Università di Pisa, Pisa, Italy_  
valentina.domenici@unipi.it

© 2018 The Author(s). Published by Taylor & Francis. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (_http://creativecommons.org/licenses/by/4.0_/_), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.  
https://doi.org/10.1080/1358314X.2018.1438040

Bent-shaped liquid crystals: structures and physical properties, by H. Takezoe and A. Eremin, Boca Raton, CRC Press, 2017, 267 pp., £170 ($220, 170 Euro) (hardcover) ISBN-13: 9781482247596

For roughly two decades, we have now had some new additions to the zoo of liquid crystal phases, bent-core liquid crystals, which for individual phases that are distinctly different from calamitic and discotic ones. These have raised much attention due to the observation of chiral effects like helical superstructures, ferroelectricity or antiferroelectricity from achiral mesogens.

Now that the field has somewhat matured, the first comprehensive monograph was published by CRC Press of the Taylor & Francis Group, after only a few journal review articles had appeared in literature before. The publication is thus timely and very much needed in the field of liquid crystals, since bent-core liquid crystals are still a major aspect of research in the field. On somewhat more than 260 pages and in nine chapters, Hideo Takezoe and Alexey Eremin, both leading experts in the field, summarise the current state of knowledge of these interesting materials. As written in the subtitle of the book, a special emphasis is placed on the structures of phases and their physical properties, rather than materials and their synthesis.

As usual, the monograph proceeds in Chapter 1 with a very brief introduction into liquid crystals and the mesogenic state of matter before it provides a historical outline of the factors leading to the discovery of polarity and chirality of bent-core phases. Personally, I like these historical comments, because they put a research topic into the perspective of the whole field. Who would have thought that Daniel Vorländer was the first to synthesis bent-core mesogens in 1929, when those materials only gained real interest from about 1996 onwards? With Chapter 2 we jump straight into the theoretical descriptions of bent-core phases, summarising the work of Brand, Cladis, Lubensky, Bisi, Lorman and others who proposed a phenomenological approach. Molecular approaches, mainly going back to the work of Osipov, and computer simulations (Boulder group), are further introduced and discussed.

By far the longest chapter of the book, Chapter 3, is not surprisingly devoted to the structures of different bent-