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Book Reviews

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Book Reviews†

Ferroelectric Liquid Crystals: Principles, Properties and Applications by J. W. Goodby, R. Blinc, N. A. Clark, S. T. Lagerwall, M. A. Osipov, S. A. Pikin, T. Sakurai, K. Yoshino, and B. Zeks, Gordon and Breach Science Publishers, Philadelphia, 1991; ISBN 2-88124-282-0; xi + 474 pages; $70.00, £39.00.

This book is Volume 7 of the series Ferroelectricity and Related Phenomena edited by George W. Taylor. Following the theoretical prediction of their existence by R. B. Meyer in 1974, the field of ferroelectric liquid crystals (FLC) has grown rapidly. The nine authors of this book are leading investigators in the field. The book consists of six chapters: an introduction; properties and structures; theory; chemical and electrical properties; FLC in electrical and magnetic fields; applications. References are given at the end of each chapter and an eight page subject index is included.

Structural Investigation of Polymers, by G. Bodor, Ellis Horwood, New York, London and Akademiai Kiado, Budapest, 1991; ISBN 0-13-852989-2; $83.25.

This text provides a concise description of a variety of topics in polymer physics. Part one sufficiently describes the nature of polymer molecules with adequate detail on the concept and consequences of high molecular weight and the common methods of determination. The thermodynamics of polymer solutions is condensed to a very readable 11 pages that provides the basis for molecular weight measurements.

Part two begins with a very sound survey of prior studies in polymer morphology. The hierarchy of polymer structure is presented with sketches and corresponding micrographs that enable the reader to visualize the complexity of polymer morphology. The effect of orientation is briefly described with much more emphasis on measurement techniques than on structural relationships. Techniques involving x-ray diffraction (both small-angle and wide-angle) are described in a useful manner. The data analysis, especially for small-angle x-ray scattering, could be expanded to include the useful quantities of domain boundary diffuseness and the degree of phase separation. A description of Porod's Law and the accompanying analysis would suffice. The application of spectroscopic techniques is briefly discussed with good descriptions of how to extract the structural information from the data.

A helpful addition of recommended literature per chapter at the end of the text

† Unsigned book reviews are by the Book Review Editor.

includes titles. This makes it easier for the reader to use as a reference. Overall, the information in this text was nicely compiled and adequately written.

Regarding this text, I would not hesitate to use this in a course on Polymer Physics. Overall, it appears to be a useful reference for undergraduate seniors or first year graduate students.

Leonard J. Buckley
Naval Air Warfare Center
Aircraft Division Warminster
P.O. Box 5152
Warminster, PA 18974-5152

Present address:
Naval Research Laboratory
Washington, DC 20375

Liquid Crystals: Applications and Uses Vol 3; B. Bahadur, ed., World Scientific, 1992; ISBN 981-02-0403-5; 424pp.

The third volume of the three volume Series "Applications and Uses of Liquid Crystals" by Birendra Bahadur complements volumes 1 and 2 by reviewing additional applications not covered there. Each of the chapters is written in an interesting manner with up-to-date references until about 1991. This renders the series suitable as a work of reference for those working in the field and as a text book for students interested in applications.

Liquid crystal surface interactions are crucial for the operability of all liquid crystal devices. A better understanding of the complex interactions is essential, both for the design of novel liquid crystal alignment techniques and for the improvement of the performance of LC-devices. The review of the subject by T. Uchida and H. Seki in the first chapter is well presented without hiding the fact that only little is known on the complex mechanisms governing the interactions. Especially useful is the practical approach of the authors who detail various alignment procedures, aligning agents and the experimental techniques to determine surface anchoring energies.

The extensive chapter on guest-host liquid crystal displays (GH-LCDs) by B. Bahadur provides a detailed and complete description of the numerous types of GH-effects. The interesting but rather limited applicability of GH-LCDs and their potential are reviewed. Moreover, some important requirements on the guests (dyes) and on the liquid crystals (hosts) required to achieve the desired performance are outlined. Because of the large number of GH-effects and the sometimes subtle differences between them, a chronological list of the effects at the beginning would have been helpful. The chronology would also clarify the sometimes ambiguous references made to the original literature.

Perhaps too often liquid crystals are associated only with their most prominent

application, i.e. displays. Potential applications of liquid crystals in parallel optical computing and processing are barely considered. This gap in the LC-literature is closed by the inspiring chapter of N. A. Clark and K. Johnson who review the many optical computing and parallel processing schemes in which liquid crystal spacial light modulators could beneficially be employed. The authors concentrate on the concepts and not so much on the liquid crystal devices. Useful comparisons are made between conventional electro-optical materials and liquid crystals.

The chapter by S. Kobayashi and A. Mochizuki "Other Types of LCDs" discusses those electro-optical effects which have not been covered in other chapters of the series. The detailed and illustrative treatment of the diverse operating principles of the "other" nematic cholesteric and ferroelectric electro-optical effects, of which many have been discovered only within the past few years, helps to judge their potential in future LCDs. Because of their novelty quite a few of the recent effects have not yet made a break-through into mass production. However, as great efforts are being made to further advance their performance the authors may soon have to review this rapidly expanding field again.

The chapter "Thermochromic Liquid Crystals" by I. Sage covers a well known and early applied property of liquid crystals: the strong temperature sensitivity of the selective reflection of light by chiral phases. The required properties and preparation of chiral liquid crystal materials as well as their microencapsulation in forms suitable for the diverse applications are reviewed and illustrated in detail.

An introduction and review of the fascinating new class of liquid crystal polymers which combines the anisotropic properties of classical monomeric liquid crystals with the specific properties of polymers is given by H. Finkelmann, W. Meier and H. Scheuermann. The interesting design concepts and the prospects for future applications of LC-polymers, for instance in optical storage devices or in piezoelectric sensors, are very well introduced, outlined, and compared with their conventional counterparts. Emphasis is put on liquid crystal side-chain polymers and their many potential applications.

I draw attention to the following errors in volume 3:

- On page 187, chapter 11.13.6 all references referring to my publication are incorrect. The correct reference is not 221 but 218.
- In chapter 11.8.5 the term "Twisted Heilmeier" guest-host effect is used. Since Heilmeier never worked with twisted structures this is clearly misleading.
- The pitch data of the cyclohexane ring containing cholesteric LCs in Table 20.7, page 321, must be incorrect (too small). Moreover, reference to the original data would help.

Martin Schadt
F. Hoffmann-LaRoche, Ltd.
CH-4002 Basel, Switzerland

Polymerization in Organized Media, edited by Constantinos M. Paleos, Gordon and Breach Science Publishers, 1992; xi + 454 pages; ISBN 2-88124-538-2; $110.00.

This multi-contributor book, from leading research workers, uniquely focuses on the direct relationship between monomeric molecular structures and their polymerized counterparts with emphasis on systems which possess order and mobility under certain conditions. The book is organized into seven chapters, Reactions and Interactions in Liquid Crystalline Media, Polymerization at Interfaces, Polymerization of Micelle-forming Monomers, Polymerization in Microemulsions, Polymerization in Vesicular Media, Polymerization in Constrained Media, and Template Polymerization. These chapters effectively encompass the wide variety of organized molecular assemblies and supramolecular architectures which are of such great research interest today. Each chapter begins with a short introduction and then expands into detailed discussions of specific topics which highlight recent developments with that particular system, and then ends with a summary of the problems and promising aspects associated with that method of polymerization. For example, the chapter on Polymerization at Interfaces, by Bernd Tieke covers the topics of Polymerization of Monomolecular Layers at the Gas-Water Interface, Polymerization in Langmuir-Blodgett Films, Polymerization of Vacuum Deposited Films, and Formation of Mono- and Multilayers by Self-Assembly. An unusual, but very thought provoking chapter is presented by Mikiji Miyata on Polymerization in Constrained Media. He begins by posing an analogy between our homes and molecular houses, and the necessary architectures required for maximum accommodation. Breaking the complexities of low-dimensional space, assembly and polymerization down to this level may give one new insight regarding molecular assemblies and is worth reading. All the chapters are well organized, extensively referenced and the text is nicely supplemented with appropriate figures and detailed tables to make for easy, clear, and concise reading.

This book provides a novel treatise in comparison with other publications on organized polymers or organized molecular assemblies in that it really hones in on the vital role that a variety of monomeric organizations play towards the observed formation and properties of the resulting polymerization products. Many of these reactions have potential towards a wide range of applications including optical devices, sensors (chemical, biological and physical), pharmaceuticals and biological membrane studies.

This book is highly recommended for anyone interested in either an excellent overview of polymerization in organized media (as the title states), a thorough introduction to a specific polymerizable system, or a quick reference book. It should prove useful and stimulating to both academic and industrial researchers, whether they be of organic, biological, physical, colloid or polymer disciplines.

Lynne A. Samuelson
U.S. Army Natick Research, Development
and Engineering Center
Natick, MA 01760

Low-Dimensional Organic Conductors. By Andrzej Graja (Institute of Molecular Physics, Polish Academy of Sciences, Poznań, Poland). World Scientific: Singapore. 1992. 306 pp. IBSN 981-02-0477-9.

The book is a reprinted and slightly expanded version of the Polish edition published in 1988. The book is divided into seven chapters. The first two chapters are introductory. Chapter 1 gives a very abbreviated history of conducting organic crystals and makes general remarks on one-dimensional systems. Chapter 2 essentially introduces solid state physics of one-dimensional systems. The remaining chapters discuss conducting organic crystals (Chapter 3), conducting polymers (Chapter 4), electrochemical methods for the preparation of organic conductors (Chapter 5), device capabilities of these materials (Chapter 6), and some speculation on future directions in molecular electronics (Chapter 7). The book does not attempt to be exhaustive in presentation.

The excellent presentation of the solid state physics and device applications of organic conductors makes this a unique book. These topics are usually very weak or non-existent in reviews and other books on the subject. Chapter 2 describes the physics of conducting organic charge transfer complexes and radical ion salts in terms of classic solid state physics. The author does an outstanding job of clearly describing the necessary physics that one needs to understand one-dimensional systems, while avoiding more complex and esoteric physics. The chapter is written clearly and appropriately at a level that readers with a minimal background in quantum mechanics can understand. Chapter 2 is very well done. Chapter 6 discusses the device capabilities and properties of these materials and is an excellent mixture of science and technology. The author gives insight into the pros and cons of one-dimensional organic materials.

The chapter on the structure and properties of conducting organic crystals (Chapter 3) is good. The tabular data on electrical conductivities is well done, although references to the original papers would have improved this table. This chapter and the book as a whole are weak on key structural data and discussion of organic superconductors that include the Bechgaard and ET salts. The book is also a bit heavy on thermopower and radical cation salts of TCNQ.

The chapter on conducting polymers basically describes the properties of polyacetylene. The book does not attempt to comment extensively on other conjugated polymers. The sections on polyacetylene are informative and provide understanding of some of the concepts in these materials.

Other than a few minor negative points, this is an excellent book on low-dimensional organic conductors. The book is written to present both understanding and inspiration. The author finally inspires creativity in the last couple of chapters and the book indeed provides the basis for future ideas. The book would be an excellent addition to the library of chemists and physicists working on one-dimensional systems.

Richard D. McCullough
Carnegie Mellon University
Department of Chemistry
Pittsburgh, Pennsylvania 15213-3890