Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/gmcl19

Book Reviews

Version of record first published: 04 Oct 2006.

To cite this article: (1996): Book Reviews, Molecular Crystals and Liquid Crystals Science and Technology. Section A. Molecular Crystals and Liquid Crystals, 289:1, 315-318

To link to this article: http://dx.doi.org/10.1080/10587259608042331

Mol. Cryst. Liq. Cryst., 1996, Vol. 289, pp. 315-318
Reprints available directly from the publisher
Photocopying permitted by license only

Book Reviews

One-Dimensional Metals, by Siegmer Roth; VCH Publishers, Weinheinm, Germany; ISBN 3-527-268-75-8; Xii + 247 pages; DM 148; sFr 148.

Professor Roth has offered a concise book derived from a series of lectures developed for a course entitled: "Physics in One-Dimension" at the University of Karlsruhe. The material presented is appropriate and comprehensible for an interdisciplinary audience. Professor Roth carefully defines necessary terminology in the jargon of the solid state physicist and chemist. Fundamental principles are well described. For example, Chapter 1 provides a clear definition of dimensionality with examples that can be easily visualized by chemistry and physics students. Professor Roth's historical description is interesting and gives the reader a sense of the breadth of 1-D materials. He provides a particularly lucid discussion of reciprocal space. Students of chemistry and perhaps physics sometimes find the notion of reciprocal space daunting and do not "adapt" to k-space or Brillouin zone. This description is clear and logical suggesting that the reciprocal space is merely a "convenient" coordinate system for electronic processes. Other strengths in the work include the definitions and examples used to characterize conjugation, defects; solitons and polarons and bipolarons. The discussion of conducting polymers and superconductivity provides a reasonable introduction into the field, providing information for theory and measurement. The role of l-D materials in molecular electronics and technical applications are well abstracted in the last two chapters.

The book is organized fairly well, providing definitions and historical perspectives in the first chapters and ending with materials design and future directions. Important theoretical descriptions, electronic and structural mechanisms aid in the development understanding the l-D material. However, there are some difficulties in organization and presentation. The Fermi surface is first introduced in Chapter 3. A representation of a one dimensional Fermi surface is shown, but the role of the Fermi surface is not clearly discussed in that context or later in the text. Band representations are shown but the band curvature/shape is not described. By comparison, the reciprocal space is well

described. The Peierls transition described in Chapter 4 is a well known structural transition for 1-D systems occurring in many polymeric materials and in charge transfer salts. The effect of the Peierls transition on electrical conductivity is shown in representations of the 1-D band structure and DOS. However few examples showing structural defects and/or related effects on electronic wavefunctions are provided to demonstrate the extent to which 1-D systems are affected or to help the reader visualize the Peierls transition in "real" materials. Examples of such abound.

From an organization stand point it seems as though the discussion of charge and spin density waves should follow the discussion of lattice distortion and electron/phonon coupling however this discussion is "tucked" in between superconductivity and molecular electronics. It seems a bit out of place. The chapter on conducting polymers focusses on conductivity mechanism and theory, but lacks description of chemical constituency of the conductive material or conductivity limits in polymeric materials of different constitution The most significant presentation of chemical information occurs in chapter two, well separated from the latter discussion on electrical properties. Doping effects on conductivity are described in terms of creating conjugational defects, but dopant level and conductivity is not discussed in any significant detail. In contrast the discussion of superconductivity is more complete including a table of superconducting elements, alloys, organic salts and ceramic oxides.

Overall this work provides an excellent overview of l-D materials. It is highly readable for students entering the field but is probably not appropriate for in depth study of l-D materials or theory. Within the last ten years or so many significant monographs on l-D materials have been published. Many of these works describe the materials and conduction phenomena of l-D materials in significantly greater depth and complexity. Some of these appear in the appendix of related references. The student or professional interested in the study of 1 -D materials should consider Professor Roth' s text an introduction to an exciting field.

SUSAN A. JANSEN,
Department of Chemistry, Temple University
Philadelphia PA 19122

***"Electrical, Optical, and Magnetic Properties of Organic Solid State Materials III"**, A. K-Y. Jen, C. Y-C. Lee, L. R. Dalton, M. F. Rubner, G.E. Wnek, and L.Y. Chiang, editors, Materials Research Society Proceedings Volume

*Unsigned book reviews are by the Book Review Editor.

413, Materials Research Society, Pitssburgh, Pennsylvania, 1996; ISBN1-55899-316-9; xix + 713 pages; $65.00; $59.00 (MRS members).

This book contains the proceedings of a Materials Research Society symposium of the same name held in Boston, Massachusetts on November 27-December 1, 1995. The two previous MRS Proceedings with the same title are Volumes 247 and 328. The book is divided into five parts, Part I: Organic Light Emitting Materials and Devices (17 papers); Part II; Photonic Materials and Devices (24 papers); Part III: Magnetic Properties and Liquid Crystal Displays (8 papers); Part IV: Molecular Engineering of Organic Solid State Materials (14 papers); Part V: Organic Conducting Polymers (38 papers). It also contains author and subject indeces. The volume will be of interest to materials scientists, chemists, physicists, and device engineers who are active researchers or students active in the subject areas of this book.

Metallomesogens: Synthesis Properties, and Applications Edited by J. L. Serrano, VCH Publishers, 1996, ISBN 3-527-29296-9; xix + 498 pages; DM298; SFr 289.

Investigations of metal containing liquid crystals, metallomesogens, have consistently increased over the last decade. Due to this fledging nature, this book has been able to present a comprehensive summary of the field. Indeed it appears that a diligent effort was made by the Zaragoza liquid crystal group to cover the complete literature through the middle of 1995.

The book, while perhaps most useful to an individual working in the field, will also serve as an introduction to metallomesogens and to liquid crystals in general. The introductory chapter is directed at the individual who has minimal knowledge of liquid crystals. I applaud this effort to write a "self-contained" book which can serve as a vehicle to bring new researchers with interests in inorganic and organometallic chemistry into the field of liquid crystals. Indeed, I would have benefited from such a book when I began liquid crystal research.

Part A of the book (Chapters 2–5) covers the different types of metallomesogens (lyotropic, calamitic, discotic, and polymeric). The phase beha- viors of the compounds are clearly outlined in tables accompanying the chemical structures. Trends are described when possible, and there is a sprinkling of insightful comments. The description of the materials in Chapter 4 as "discotic" is misleading, since a number of metallomesogens which display columnar phases have decidedly non-discoid structures.

In Part B the book endeavors to describe the design and synthesis of low molecular weight metallomesogens (Chapter 6) and metallomesogenic polymers (Chapter 7). As a synthetic chemist, I personally find the synthesis of most

metallomesogens to be very elementary. However, these chapters may be of interest for researchers not familiar with basic chemical synthesis and are consistent with the "self-contained" goal of the book.

Structural characterization by X-rays and EPR is discussed in Chapters 8 and 9 (Part C). The special properties of transition metals lend themselves to studies by EXAFS and EPR. Part D is dedicated to the physical properties and applications of liquid crystals. It is not too surprising that metallomesogens have not found broad application since they have only seen significant investigation in recent years. I commend the authors effort to discuss possible applications and such a summary will help technologists to find uses for metallomesogens.

The book is not without some shortcomings. The format tends to make for repetitive discussions. For example, compounds from Part A are discussed again in Parts B, C, or D. A quick scan through the book will reveal that a number of key graphics and chemical structures appear more than once. These duplications may lead to a more clear presentation, but I cannot help but wonder if the length of the book, and hence its price, could have been significantly reduced. In addition, given the rapid progress in this area, the book will most likely be out of date in a few years.

However, when taken in total, I believe that the book will be a true resource for researchers with an interest in metallomesogens and will be a particular aid for newcomers to the field.

Timothy M. Swager*
Department of Chemistry
University of Pennsylvania
Philadelphia, Pennsylvania 19104-6323

*Present address:
Department of Chemistry
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139