Liquid Crystals Experimental Study Of Physical Properties And Phase Transitions

This edited volume provides an extensive overview of how nuclear magnetic resonance can be an indispensable tool to investigate molecular ordering, phase structure, and dynamics in complex anisotropic phases formed by liquid crystalline materials. The chapters, written

by prominent scientists in their field of expertise, provide a state-of-the-art scene of developments in liquid crystal research. The fantastic assortment of shape anisotropy in organic molecules leads to the discoveries of interesting new soft materials made at a

rapid rate which not only inject impetus to address the fundamental physical and chemical phenomena, but also the potential applications in memory, sensor and display devices. The review volume also covers topics ranging from solute studies of molecules in nematics

and biologically ordered fluids to theoretical approaches in treating elastic and viscous properties of liquid crystals. This volume is aimed at graduate students, novices and experts alike, and provides an excellent reference material for readers interested in the liquid crystal

research. It is, indeed, a reference book for every science library to have. Sample Chapter(s). Chapter 1: Novel Strategies for Solving Highly Complex NMR Spectra of Solutes in Liquid Crystals (1,464 KB). Contents: Novel Strategies for Solving Highly Complex NMR Spectra of Solutes in

Liquid Crystals (E E Burnell et al.); Analytical Potentials of Natural Abundance Deuterium NMR Spectroscopy in Achiral Thermotropics and Polypeptide Chiral Oriented Solvents (P Lesot & C Aroulande); Noble Gas Probes in NMR Studies of Liquid Crystals (J Jokisaari);

Bicelles OCo A Much Needed Magic Wand to Study Membrane Proteins by NMR Spectroscopy (R Soong et al.); Advances in Proton NMR Relaxometry in Thermotropic Liquid Crystals (P J Sebastiuo et al.); Deuterium NMR Study of Magnetic Field Distortions in

Ferroelectric Mesogens (R Y Dong); Deuteron NMR Study of the Effects of Random Quenched Disorder in 12CB Silica Dispersions (D Finotello & V Pandya); Dynamics of Liquid Crystals by Means of Deuterium NMR Relaxation (C A Veracini & V

Domenici); Translational Self-Diffusion Measurements in Thermotropics by Means of Statistic Field Gradients NMR Diffusometry (M Cifelli); Deuterium NMR Studies of Static and Dynamic Director Alignment for Low Molar Mass Nematics (A Sugimura & G R

Luckhurst); Viscoelastic Properties of Liquid Crystals: Statistical-Mechanical Approaches and Molecular Dynamics Simulations (A V Zakharov); Carbon-13 NMR Studies of Thermotropic Liquid Crystals (R Y Dong); A Combined DFT and Carbon-13 NMR

Study of a Biaxial Bent-Core Mesogen (A Marini et al.).

Readership: Chemists, physicists and material scientists. In particular, NMR spectroscopists.

Publisher Description

The alignment control of liquid crystal (LC) molecules is of great importance for the

most of LC based electro-optical applications such as displays, modulators, and variable attenuators. This control realises, particularly, by the interactions between LC molecules and the adjacent surface. This makes the surface alignment one of the key factors for the

improvement of LC-based devices' performance. This PhD thesis reports an experimental study of alignment control of LC molecules by surfaces, and explores the possibility of practical avenues. First, dual frequency nematic LCs (DF-NLC) and thin reactive mesogen

(RM) films, cast on internal surfaces of cell substrate, were used to build surface polymer stabilized structures. To form these surface-stabilized structures, a partial interpenetration between the LC and RM molecules was allowed while applying an orienting

dielectric torque (positive or negative) to the material system. Then, after a short interpenetration period between the RM layer and the bulk LC, UV exposition was added to definitely cure the material system. These systems demonstrated great potential for the

surface alignment control of LCs, enabling the "programming" of LC cells with electrically controllable light scattering, which can be used in privacy windows and smart lighting applications. Electro-optic and microscopic studies were done to characterize these

surface-stabilized structures. We showed that the contrasts of light scatter modulation, polarization dependence and response times can be noticeably improved by the dual-frequency control. Afterward, dual frequency chiral LCs (DF-CLC) were used

to build surface-stabilized structures, which in addition to the controllable scattering, showed also resonant reflection phenomenon. Partially cured and oriented RM layers were used as alignment layers for DF-CLC. The role of the pre-curing

duration of RM in the behavior of the cell was observed by electro-optical and spectroscopic studies. Our morphological studies showed that the molecular interdiffusion between RM layer and bulk LC during the programming process generates polymer aggregates on the

cell's internal surfaces, which are at the origin of formation of controllable light scattering.

This book explores why the properties of liquid crystals make them ideal for use in photovoltaic applications. It achieves this by presenting a description of the

properties of liquid crystals and how their electronic properties compare to that of polymers used in organic photovoltaics. It explores how the type of liquid crystal chosen can help in improving the efficiency of the photovoltaics. It compares experimental and

theoretical ways in which the efficiency is directly or indirectly estimated between the organic photovoltaics and the organic photovoltaics that contain a liquid crystal. It first introduces liquid crystals and their different varieties, before reviewing their electronic transfer

properties and how they can improve efficiency. It is an ideal text for graduate students and young researches considering entering the area of photovoltaics - specifically, organic photovoltaics □ who do not yet have knowledge of this field. Introduces the

field of liquid crystals and provides basic information to those new to the field, in a concise and visual manner Describes which characteristics of a liquid crystal are most advantageous to use in photovoltaics Provides basic knowledge of photovoltaics for those who do not

have previous knowledge of how they behave electronically

Experimental Study on Heat Transfer Characteristics of Microchannel Systems Using Liquid Crystal Thermography

Concepts and Physical Properties Illustrated by Experiments

Nature's Delicate Phase of Matter

An Experimental Study of Pretransitional Effects Near Nematic to Smectic-A Liquid Crystal Phase Transitions

Reviews recent studies of X-ray scattering

phenomena in liquid crystals, in particular their relationship to phase-transition physics. Also explored are the main approximations which are used to obtain structural information from

the scattering spectre of liquid crystals and to determine the short-range order in the molecule arrangement. The book intends to give a state-of-the-art overview of flexoelectricity, a linear physical

coupling between mechanical (orientational) deformations and electric polarization, which is specific to systems with orientational order, such as liquid crystals. Chapters written by experts

in the field shed light on theoretical as well as experimental aspects of research carried out since the discovery of flexoelectricity. Besides a common macroscopic (continuum)

description the microscopic theory of flexoelectricity is also addressed. Electro-optic effects due to or modified by flexoelectricity as well as various (direct and indirect) measurement

methods are discussed. Special emphasis is given to the role of flexoelectricity in pattern-forming instabilities. While the main focus of the book lies in flexoelectricity in nematic liquid crystals,

peculiarities of other mesophases (bent-core systems, cholesterics, and smectics) are also reviewed. Flexoelectricity has relevance to biological (living) systems and can also offer

possibilities for technical applications. The basics of these two interdisciplinary fields are also summarized. This 2001 book provides hands-on details of several important

techniques for the study of liquid crystals.

This book describes the state of the art of our understanding of liquid-crystal interfaces on a molecular level. The interactions of liquid crystal

molecules with a surface play an essential role in the operation of liquid crystal displays (LCD's) and other LC devices that are based on the controllable anchoring of LC molecules on

polymer coated surfaces. This book addresses the microscopic interaction between a macromolecule (liquid crystal, polymer) and a wall, using state of the art surface and interface-sensitive

experimental techniques, such as Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Linear and Nonlinear Optical Microscopy and (Dynamic) Light Scattering (DLS).

These experimental techniques were complemented with computer simulations and supra molecular chemistry methods to develop controllable polymeric surfaces.

Liquid Crystal Polymer Nanocomposites
Concepts and Physical Properties Illustrated by Experiments, Two Volume Set
Biaxial Nematic Liquid Crystals
Liquid Crystals and

Ordered Fluids
An Experimental Study of Solidification in a Simulated Czochralski System Using Liquid Crystal Thermography
Practically every display technology in

use today relies on the flat, energy-efficient construction made possible by liquid crystals. These displays provide visual ly-crisp, vibr antly-colored

images that a short time ago were thought only possible in science fiction. Liquid crystals are known mainly for their use in display technologies,

but they also provide many diverse and useful applications: adaptive optics, electro-optical devices, films, lasers, photovoltaics, privacy

windows, skin cleansers and soaps, and thermometers. The striking images of liquid crystals changing color under polarized lighting

conditions are even on display in many museums and art galleries - true examples of 'science meeting art'. Although liquid crystals

provide us with visually stunning displays, fascinating applications, and are a rich and fruitful source of inte rdisciplinary research, their full

potential may yet remain untapped. While much fundamental research is still performed with pure liquid crystals, industrial applications

employ mostly mixtures, composites, or specially doped liquid crystals with tailor-made physical and optical proper ties.Current progress and large scale

application of liquid crystals in optical technology are largely the result of tremendous advances in such new material development

efforts.Liquid crystal mixtures formed by different concentrations of the same set of constituents should be regarded as physically and

optically different materials.The book contains the experimental work carried on the composite system formed using cholesteric

liquid crystal Cholesteryl Pelargonate-(CP)], polymer Poly Methyl Methacrylate(PMMA)] and azobenzene(orange) dye.The parameters that are investigated

are the textures, the phase transition temperatures, the absorption in the visible range and infrared absorption.The parameters were

investigated for(i)the pure CP, (ii)the composite system formed using CP and PMMA and (iii) for the composite system formed using CP, PMMA and azobenz

Soon after she became involved in the didactics of physics, the author of this book realized that the transfer of new discoveries in physics into

schools and to undergraduate programs is almost non-existent. Such an introduction is difficult as students' k This book is based on a NATO Advanced

Study Institute held to enhance our understanding, at both an experimental and a theoretical level, of the molecular dynamics in liquid

crystals. The lecturers at the Institute, each leaders in their respective fields, have contributed chapters to the book with the aim of producing, for

the first time, a coherent, pedagogical account of this interdisciplinary subject. The range of materials considered is wide,

including lyotropic and thermotropic liquid crystals, biological membranes and polymeric systems. The formalism needed to characterise

the rotational, translational and conformational dynamics is developed. Then the use of experimental techniques to investigate

the dynamics is described; these techniques include NMR and ESR spectroscopy, neutron scattering, dielectric relaxation, infrared

spectroscopy and fluorescence d epolarisation. Some of these experiments are influenced by the collective orientations or director modes which

are also considered. The results of these experiments are presented and the theory necessary to understand them is described, with

particular attention being paid to the influence of the long range liquid--crystalline order on the dynamics. Liquid Crystals in Photovoltaics

Advances in Liquid Crystals Surfaces and Interfaces of Liquid Crystals An Experimental Study of Pretr ansitional Effects of

Liquid Crystal Phase Transitions

Liquid Crystal Elastomers

This book summarizes the theoretical and experimental studies confirming the concept of the

liquid-crystalline nature of boundary lubrication in synovial joints. It is shown that cholesteric liquid crystals in the synovial liquid play a significant

role in the mechanism of intra-articular friction reduction. The results of structural, rheological and tribological research of the creation of artificial synovial

liquids containing cholesteric liquid crystals in natural synovial liquids are described. These liquid crystals reproduce the lubrication properties of

natural synovia and provide a high chondropro tective efficiency. They were tested in osteoarthritis models and in clinical practice. Describes the main aspects of

chirality in liquid crystals, and points out some of the open questions of current research. The chapters review the highlights of the important topics and

questions. Proceedings of the NATO Advanced Research Workshop on Computer Simulations of Defects in Liquid Crystals Including their Relation to Theory and

Experiment, held in Erice, Sicily, Italy, 19-23 September 2000

Liquid Crystals Experimental Study of Physical Properties and Phase Transitio nsCambridge University

Press

An Introduction to Liquid Crystals

Defects in Liquid Crystals: Computer Simulations, Theory and Experiments

Experiments with Liquid

Crystal-Polymer Composite System

Study of Solid Surface Interactions with Binary Liquid Mixtures and Liquid Crystals

Liquid Crystals through Experiments

Liquid crystals are partially ordered systems without a rigid, long-range structure. The study of these materials covers a wide

area: chemical structure, physical properties and technical applications. Due to their dual nature -- anisotropic physical properties of solids and

rheological behavior of liquids -- and easy response to externally applied electric, magnetic, optical and surface fields liquid crystals are

of greatest potential for scientific and technological applications. The subject has come of age and has achieved the status of being a very exciting inter

disciplinary field of scientific and industrial research. This book is an outgrowth of the enormous advances made during the last three decades in

both our understanding of liquid crystals and our ability to use them in applications. It presents a systematic, self-contained and up-to-date overview of

the structure and properties of liquid crystals. It will be of great value to graduates and research workers in condensed matter physics,

chemical physics, biology, materials science, chemical and electrical engineering, and technology from a materials science and

physics viewpoint of liquid crystals. These volumes are a result of the personal research and graduate lectures given by the authors

at the École Normale Supérieure de Lyon and the University of Paris VII, respectively. Featuring an e asy-to-follow, accessible style, each volume

describes important concepts and physical properties using classroo m-friendly experiments, many of which the professors used in their own classes,

and clear diagrams. Although Smectic and Columnar Liquid Crystals: Concepts and Physical Properties Illustrated by Experiments

can be used as an independent text, it is an ideal and complementary companion to Nematic and Cholesteric Liquid Crystals: Concepts and Physical

Properties Illustrated by Experiments. Featuring topics that seldom appear in current literature, these volumes represent an ideal introduction

and a valuable source of reference for theoretical and experimental studies of advanced students and researchers in liquid crystals,

condensed matter physics, and materials science. This book covers developments in the field of thermotropic liquid

crystals and their functional importance. It also presents advances related to different sub-areas pertinent to this interdisc iplinary area

of research. This text brings together research from synthetic scientists and spectroscopist s and attempts to bridge the gaps between these areas.

New physical techniques that are powerful in characterizing these materials are discussed. Liquid crystals allow us to perform experiments

that provide insight into fundamental problems of modern physics, such as phase transitions, frustration, elasticity, hydrodynamics, defects,

growth phenomena, and optics. Smectic and Columnar Liquid Crystals: Concepts and Physical Properties Illustrated by Experiments is

a result of personal research and of the graduate lectures given by the authors at the École Normale Supérieure de Lyon and the University of

Paris VII, respectively. The book examines lamellar (smectic) and columnar liquid crystals, which, in addition to orientational

order, possess 1D, 2D or 3D positional order. This volume illustrates original physical concepts using methodically numerous experiments,

theoretical developments, and diagrams. Topics include rheology and plasticity, fe rroelectricity , analogies with supercond uctors, hexatic order and 2D-

melting, equilibrium shapes, facetting, and the Mullins-Sekerka instability, as well as phase transitions in free films and membrane

vibrations. Nematic and cholesteric liquid crystals are covered by the authors in a separate volume entitled Nematic and Cholesteric

Liquid Crystals: Concepts and Physical Properties Illustrated by Experiments. Smectic and Columnar Liquid Crystals is an ideal

introduction and a valuable source of reference for theoretical and experimental studies of advanced students and researchers in liquid

crystals, condensed matter physics, and materials science.

An Experimental Study of the Rheology of Thermotropic Liquid

Crystalline Co-polyesters
The Physics of Ferroelectric and Antiferroelectric Liquid Crystals
Experimental Study of Physical Properties and Phase

Transitions
The Molecular Dynamics of Liquid Crystals
Thermotropic Liquid Crystals

This volume represents a collection of selected papers from a symposium of the

Division of Colloid and Surface Chemistry held in Chicago during the national meeting of the American Chemical Society, August, 1973. The response was remarkable to this "By Invitation" symposium on Ordered Fluids and Liquid Crystals. The size alone expresses the growth of the field.

The number of contributions assembled here, for example, is approximately twice that at each of the two previous American Chemical Society symposia on this subject. Contributions from eleven countries were presented and this volume contains more than this number

of papers from abroad. The increased attention to liquid crystals has brought some interesting trends in the kinds of systems, the experimental methods, and the nature of the lahoratories involved. There has, for example, been an impressive increase in the number of

academic studies on liquid crystals. The works herewith published also represent an im pressive variety of traditional and novel eXperimental techniques for the study of liquid crystals. These include rheology, infrared spec troscopy, dielectrics, ultrasonics, pulsed

NMR, the Kerr effect, plus thermal and electrical conductivity. Phase transitions and critical phenomena in liquids and liquid crystals have been the subject of intensive research since the 1960s. However, books on this fascinating subject have tended to be written by theorists for theorists. Professor

Anisimov offers us a new approach: he aims to introduce experimentalists to the modern theories and their applications. After introducing the thermodynamics of phase transitions, he presents the modern theory of critical phenomena. He then concludes by illustrating the utility

of this theory in the analysis of experimental measurements in classical fluids and binary mixtures, superfluid mixtures of helium isotopes and liquid crystals. Not only will this book be enjoyed by experimental physicists, chemists and material scientists,

it will also offer the theorist an insight into the interpretation of the experimentalist's work.

Advances in Liquid Crystals, Volume 3 presents some of the applications of liquid crystals, particularly those related to lyotropic and thermotropic liquid crystals. The six

articles in this volume cover the development of the theory of electrohydrodynamic properties of liquid crystals; study of lyotropic liquid crystals in the area of surfactants; liquid crystals and foams; the development of ultrasonics in liquid crystal media; and the field of liquid crystals

in chromatography. The book will be invaluable to materials engineers, inventors, physicists, and researchers in the field of electronics.

The optical properties of two examples of nonlinear periodic structures experimentally studied: colloidal crystals used as

nonlinear distributed feedback structures and nonlinear volume holographic elements. The transmission of the colloidal crystals was found to be dramatically modified by an incident field whose frequency was tuned within or near the stop gap of the crystal. Optical limiting was observed

when the frequency of the incident field was tuned to the high frequency edge of the stop gap. Optical switching and bistability were observed when the frequency was tuned to within the stop gap. The switching intensity was seen to decrease as the frequency of the incident light was

tuned further into the stop gap. This result can not be explained by the simple model of a nonlinear distributed feedback structure. The transmission was also found to exhibit temporal fluctuations at high intensities. The nonlinear volume holographic structures consisted of a porous photopolymer in which

a permanent grating was recorded and then was imbibed with a nematic liquid crystal. The diffraction efficiency of the grating was switched from high to low using a control beam power of 8.4 mW. The response time of the switching was limited by the response time of the thermal

nonlinearity of the liquid crystal and was measured to be approximately 1 ms. (MM).

Chirality in Liquid Crystals

Synovial Joint Treatment

Study of Molecular Interactions and Surface Alignment Control of Liquid Crystals

Nuclear Magnetic Resonance Spectroscopy of Liquid Crystals

Liquid Crystals in Biotribology

In a separate series of experiments, the interaction between a nematic liquid crystal and

substrate was studied, in particular, the energetic cost to deviate the surface director from its preferred orientation. To accurately determine the energetic cost, denoted by the

polar anchoring coefficient W, of a typical alignment layer/liquid crystal was measured using three techniques. The first is the 'high-electric-field' (HEF) technique was

found to give the largest value of W. In the course of the study, the HEF technique was improved by no longer requiring the measurement of capacitance of the sample liquid crystal

cell. Also, the source of the large value of W is detected, and a protocol was developed to determine the reliability of the results given by the HEF technique. Two other techniques are

used to determine W: the measurement of capacitance in a magnetic field and the measurement of the Frederiks transition at several local thicknesses within a wedge cell. Finally,

the advantages and disadvantages of each technique are discussed. Dendrimers are hyperbranched molecules with well-defined nanometer-scale dimensions. Important

technological applications of these systems, both in biomedicine and materials science, have been recently proposed. Liquid crystal dendrimers are fascinating materials that

combine the characteristics of dendrimers with the anisotropic physical behaviour and molecular self-organization typical of liquid crystals. This unique

association of physical and chemical properties, together with the possibility of multi-selective funct ionalization put forward by dendrimers, opens new perspectives

for applications. Nuclear magnetic resonance (NMR) is a powerful experimental technique applied in materials science and an important tool to the study of

molecular organization and dynamics. This book presents an introduction to dendrimers properties with special insight into liquid crystal dendrimers and a detailed

description of the NMR theory and experimental techniques used in the investigation of these materials. It also discusses recent NMR research results on

liquid crystal dendrimers, with emphasis on molecular order and dynamics studies. This book introduces the properties of dendrimers, with special insight into liquid crystal

dendrimers, and a detailed description of NMR theory and experimental techniques used in the investigation of these materials. It also discusses results of recent NMR

research on liquid crystal dendrimers, with an emphasis on molecular order and dynamics studies. Advanced undergraduate and graduate students of physics,

chemistry, and materials science and researchers in the fields of dendrimers, liquid crystals, and NMR will find the book extremely useful. Liquid Crystal

Polymer Nanocomposites summarizes, in a comprehensive manner, numerous modern technical research accomplishments on the development of nanocomposites from liquid

crystalline polymers. It emphasizes various studies at the nano-scale, including discussions of liquid crystalline block copolymers, liquid

crystalline epoxy nanocomposites, barrier property studies of liquid crystalline epoxy and their nanocomposites, liquid crystalline polymer-based

microfibrillar and nanofibrillar composites, liquid crystalline polymer/nanoplatelet nanocomposites, liquid-crystalline elastomer/graphene oxide

nanocomposites, and thermotropic liquid crystalline polymers. It provides detailed information on methods of preparation, the properties of these

materials and a discussion on the structure-properties relationship. With an emphasis on data and experimental results, the book's authors illustrate how the liquid

crystal structure can have an impact on the final properties of nanocomposite. Contains contributions from leading experts working in this specialized field of

research Provides detailed information on the preparation, characterization and application of nanocomposites of liquid crystalline polymers

Presents solutions to both fundamental and applied problems
This final report describes experimental research on the behavior of ultrasound in

liquid crystals, structure studies of liquid crystals by use of x-ray methods, degree of ordering in a nematic liquid crystal under an electric field, and synthesis

of new liquid crystalline compounds. From the theoretical point of view the application of a dipole-dipole model to liquid crystalline systems is presented. For cholesteryl

nonanoate the skin-depth penetration of the shear wave was found to be .000002m with a wave velocity of 80 m/sec at a frequency of 9.45 MH. The small penetration depth makes the

shear-wave technique ideally suited for studying surface properties of liquid crystals. Some liquid crystals take on an ordered arrangement on surfaces while

others are unordered. The dipole-dipole model of a nematic liquid crystal predicts an antiferroelectric state of order based on dipole-dipole interactions of nearest

neighbors. The model also predicts that the nematic-isotropic point should be field dependent. X-ray studies have led to the point where it can give a fairly good classification

of liquid crystals based on diffraction patterns. Infrared dichroic studies can be used to establish the degree of ordering of nematic liquids.

Smectic and Columnar Liquid Crystals Experimental Study of the Interaction of Laser Light with Liquid Crystal Guides and Gratings NMR of Liquid Crystal Dendrimers

Critical Phenomena in Liquids and Liquid Crystals Theory, Experiments and Applications

This book presents the basic physics of ferroelectric and antiferroelectric liquid crystals in

a simple and transparent way. It treats both the basic and the applied aspects of ferroelectric and antiferroelectric liquid crystal research, starting from the discovery of ferroelectricity in liquid crystals in

1975 and ending with the resonant X-ray experiment in ferrielectric and antiferrielectric phases in 1998. Particular attention is paid to the optical properties, electrooptic effects, phase

transitions and experimental methods used in liquid crystal research. Special chapters are devoted to dielectric spectroscopy, light scattering, NMR, STM and AFM in complex fluids. The more

than 300 illustrations help to present the basic physics of liquid crystalline ferroelectrics and antiferroelectrics in a way that can be easily followed by students, engineers and scientists dealing with liquid crystal

research. Contents:Symmetry, ferroelectricity and antiferroelectricity in liquid crystalsChiral phases of achiral moleculesBroken symmetry and elementary excitationsLanda u theory of ferroelectric and

antiferroelectric liquid crystalsOrder parameter dynamics, soft modes and gapless phasonsF erroelectric liquid crystals in external magnetic and DC electric fieldsPhase transitions in

thin cellsSurface-induced polaritySoliton and plane wave dynamics in thin cellsFreely suspended filmsLinear optics of helical structures Birefringence, optical rotation and quasielastic light scattering in

ferroelectric and antiferrolectric phasesLinear electrooptic response of ferroelectric and antiferroelectric liquid crystalsMa gnetic-field induced biaxiality Dielectric dispersionSoft and phase mode d

ynamicsDielectric response of a multisoliton latticePolarizatio n noiseDeuteron NMR in ferroelectric and antiferroelectric liquid crystalsAnisotrop y of the critical magnetic fieldPolar and

quadrupolar biasing of molecular rotation around the long molecular axis14N NQR and 13C NMR in tilted smectic phasesSynclinic versus anticlinic ordering in tilted smecticsOrder

parameter dynamics and a doubling of a smectic unit cell in antiferroelectric liquid crystalsOptical properties of the antiferroelectric phaseDielectric, linear and nonlinear

electrooptic response of the antiferroelectric phaseFerroelectricity, antiferroelectricity and intermediate phasesDiscrete models of intermediate phasesSTM and AFM in complex liquidsSurface

stabilized ferroelectric liquid crystal displaysUltrafast electroclinic effectDeformed helix mode ferroelectric displaysChevrons in SSFC displaysIon-director coupling and depolarization

field in SSFLCDLandau theory of second order phase transitionsSurvey of different experimental methodsNuts and bolts collection Readership: Graduate students, engineers and

scientists dealing with liquid crystals and optical display. keywords:Liquid Crystals;Soft Mat ter;Ferroelectricit y;Antiferroelectri city;Ferroelectric; Antiferroelectric; Phase Transitions ;Optics;High Magnetic Fields;S

olitons;Light Scattering;Displays

“... this is an excellent and comprehensive book, especially for those who prefer a more formal treatment of the topics ... Because many of the topics apply to

nonferroelectric liquid crystals as well, I believe that this book has an important place on the shelf of anybody who deals with liquid crystals; it is also an absolute 'must' for anybody who works on FLCs

and AFLCs." Charles Rosenblatt Case Western Reserve University "The structure of the book is extremely logical and has been well thought out ... The real strength of the book is in the clear and concise

explanations the authors give of many aspects of underlying theory and the implications of various experimental results. Many of the discussions of conflicting data and ideas are also presented in an

unbiased way. This makes the book eminently readable, not only as a resource for advanced researchers in the area, but also as a first introduction for new graduate students ... This is an essential

reference work and should occupy a place on all liquid-crystal bookcases." Journal of Applied Crystallography This text is a primer for liquid crystals, polymers, rubber and elasticity. It

is directed at physicists, chemists, material scientists, engineers and applied mathematicians at the graduate student level and beyond.

In the nematic liquid crystal

phase, rod-shaped molecules move randomly but remain essentially parallel to one another. Biaxial nematics, which were first predicted in 1970 by Marvin Freiser, have their molecules

differentially oriented along two axes. They have the potential to create displays with fast switching times and may have applications in thin-film displays and other liquid crystal technologies.

This book is the first to be concerned solely with biaxial nematic liquid crystals, both lyotropic and thermotropic, formed by low molar mass as well as polymeric systems. It opens with a general

introduction to the biaxial nematic phase and covers: • Order parameters and distribution functions • Molecular field theory • Theories for hard biaxial particles • Computer simulation of

biaxial nematics • Alignment of the phase • Display applications • Characterisation and identification • Lyotropic, thermotropic and colloidal systems together with material design With a consistent,

coherent and pedagogical approach, this book brings together theory, simulations and experimental studies; it includes contributions from some of the leading figures in the field. It is

relevant to students and researchers as well as to industry professionals working in soft matter, liquid crystals, liquid crystal devices and their applications throughout

materials science, chemistry, physics, mathematics and display engineering.

Liquid Crystals

Flexoelectricity in Liquid Crystals

A Theoretical and Experimental Study of the Flow of Liquid Crystals

Recent Advances Physical Properties of the Cholesteric Mesophase