



## Structures and Functions of Non-Disc-Shaped Columnar Liquid Crystalline Compounds

Tamejiro HIYAMA, Masaki SHIMIZU and Masanori NATA

Recent research progress on non-disc-shaped mesomorphic columnar compounds is reviewed with emphasis placed on their molecular and self-assembling structures. Our study on spherical polysila-cage compounds that exhibit columnar mesophases is also described.

**Keywords** : Non-Disc-Shaped Molecule, Columnar Phase, Spherical Molecule, Bicyclo [2.2.2] octane, Polysila-Cage Compound

## Structural Colors in Nature and their Mechanisms

Shuichi KINOSHITA

Brilliant feather of peacock has been attracting scientists' interests since the dawn of modern science. About 350 years ago, Hooke wrote in his book that its color came from thin materials existing inside the feather. Newton also commented it in his famous book. In 21st century, the peacock color has been more and more attractive along with the stream of recent nanotechnology. In the present article, we will elucidate the basic origin of such structure-based colors (structural colors) and show the beautiful colors in nature, which are originated from their sophisticated structures.

**Keywords** : Structural Color, Nanostructure, Interference, Peacock, Morpho Butterfly

## Development of Transflective In-Plane Switching Liquid Crystal Displays

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With prevailing of cellular phones receivable ground-wave digital broadcasting, high viewing performance LCD (Liquid Crystal Display) modes developed for televisions have been introduced into mobile LCDs, and viewing performances of mobile LCDs have been improved steadily. We have developed transflective IPS (In-Plane Switching) LCDs having both improved outdoor legibility and high viewing performance of transmissive IPS LCDs. In this paper, driving principle of transflective IPS LCDs and guiding principles for viewing angle performance design are presented.

**Keywords** : In-Plane Switching Liquid Crystal Displays, Transflective Liquid Crystal Displays, Mobile Liquid Crystal Displays, Viewing Angle Performance

## Molecular Design of Liquid-Crystalline Materials for Display Devices

Fumitaka OGASAWARA and Atsushi YOSHIZAWA

This review summarizes advances in liquid-crystalline materials for display devices and shows some novel approaches for improving the switching times. We propose here to organize a nematic phase with a hierarchical structure. The shorter correlation length in the nematic phase is thought to accelerate reorientation of the molecules. We designed a pre-organized U-shaped system, which was found to induce a large dielectric anisotropy in the nematic mixture with host liquid crystals. We discuss structure-property relationships in the liquid crystal oligomers to increase dielectric anisotropy without introducing a large dipole moment. Furthermore, the U-shaped system can be applied to improve the performance of practical nematic mixtures for optically compensated mode LCDs.

**Keywords** : Liquid Crystal Display, Nematic Liquid Crystals, Dielectric Anisotropy, Molecular Design

## **The Cholesteric Liquid Crystal Display Technology**

Hidekatsu SIGIHARA

The cholesteric liquid crystal display is the reflective flat panel display that needs "No Power" while maintaining an image till next image writing. The best usage is the display without battery and maintaining same image in long time. The superior wide viewing angle and the color expression are accomplished by the elimination of polarizers and color filters.

**Keywords** : Cholesteric Liquid Crystal, Electric Paper, Display, Selective Reflection, Bistable

## **Computer Simulation of Anisotropic Systems Using Coarse-Grained Models**

Hiroo FUKUNAGA

Computer simulation has been widely used to understand the origin of the phase behavior for anisotropic systems. In this article, the results of computer simulation for the coarse-grained models of the spherocylinder and Gay-Berne models are described. These coarse-grained models exhibit several liquid crystalline phases, depending on the anisotropic repulsive and attractive interactions. A terminal dipole and a flexible tail also

influence the phase behavior of the coarse-grained models. However, proper effective potentials for the coarse-grained models are required to reproduce the phase behavior of real molecules. Hence a scheme to obtain the coarse-grained potentials, which is starting from an atomistic model, is presented.

**Keywords** : Nematic Phase, Smectic Phase, Spherocylinder Model, Gay-Berne Potential, Potentials of Mean Force,

## **Anisotropic Structure in Gels Induced by a Little Amount of Rod-Like Polyelectrolyte**

Hidemitsu FURUKAWA, Yukari SHIGEKURA, Yoshihito OSADA, and Jian Ping Gong

We recently discovered that isotropic monomer solution shows birefringence due to its anisotropic structure after gelation in the presence of little amount of rod-like polyelectrolyte. The possible mechanism of the anisotropic structure formation during gelation induced by a little amount of rod-like polyelectrolyte is proposed based on the results of the recent observations.

**Keywords** : Gel, Polyelectrolyte, Birefringence, Gelation, Scanning Microscopic Light Scattering