Abstracts

Ionic Liquid Crystalline Polymers—Liquid Crystal Formation and Effects of Ionic Interactions—

Seiji UJIIE

Ionic liquid crystalline polymers are classified into four groups : main chain liquid crystalline polymers having ionic groups in the side chain or in the main chain, ionic liquid crystalline polymers having mesogenic side chains, ion complex type liquid crystalline polymers, and finally ionic liquid crystalline polymers with an ionized dendrimeric core. The ionic interactions lead to the formation of thermotropic liquid crystalline phases such as smectic, columnar, and cubic mesophases. The thermal stability of the liquid crystalline phases is enhanced by ionic sublayers formed by ionic aggregation. Ionic liquid crystalline polymers show spontaneous formation of a homeotropic alignment by physical adsorption of ammonium units. These will be reviewed in this article.

Keywords : Thermotropic, Ionic interaction, Ionic liquid crystalline polymer, Ion complex, Thermal property, Orientational structure

Recent Developments of Discotic Liquid Crystals — Switchable Polar Columnar Phases—

Hideo TAKEZOE and Keiki KISHIKAWA

Disclike molecules form various columnar phases. Many attempts have been made to make these phases polar. Among these attempts, two groups recently discovered columnar phases, in which dipoles along the column ferroelectrically switch. In this article, we summarize the attempts for realizing polar columnar phases and then introduce the two molecular systems showing switchable columnar phases.

Keywords : Columnar phase, Discotic liquid crystal, Switching, Polarization, SHG

The Synthesis and Mechanism of Formation of Helical Conjugated Polymers in Chiral Liquid Crystal Reaction Fields

Taizo MORI, Munju GOH and Kazuo AKAGI

Helical polyacetylene films in asymmetric reaction fields composed of chiral nematic liquid crystal were synthesized. A chiral nematic liquid crystal was prepared by adding chiroptical compound as a chiral dopant to a nematic liquid crystal. It is apparent that the helical polyacetylene replicates the chiral nematic liquid crystal employed as an asymmetric reaction field. However, the formation mechanism of helical polyacetylene still remains unclarified. Here, we present the formation mechanism for spiral morphology of helical polyacetylene in chiral nematic liquid crystal fields.

Keywords : Helical polyacetylene, Chiral nematic liquid crystal, Asymmetric reaction field, Helical structure, Hierarchy

Molecular Statistical Interpretations of Surface Orientation for Liquid Crystals

Hatsuo KIMURA

Molecular statistical expressions for the surface tension are given as functions of molecular tilt angle using molecular parameters : molecular length and width, and five coefficients of intermolecular attractive potential. By determining the tilt angle and its temperature dependence where surface tension is minimized, experimental data of various liquid crystals at the free surface and solid surfaces can be interpreted from their molecular properties.

The surface orientation of disk-like molecules is discussed and compared with rod-like molecules.

A simple molecular model is proposed, an expression of the anchoring energy on the treated surface is given, and the origins of the tilt angle and its temperature dependence discussed. As all the given expressions are

physically clear and mathematically easily treatable, they enable interpretation and explaintion to the molecular mechanisms of orientations at various surfaces.

Keywords : Surface tension of liquid crystals, Model of cylindrical molecules, Anchoring energy, Rod-like and disk-like molecules, Temperature dependence of tilt angle

Planar-Type Liquid Crystal Diffractive Optical Elements Obtained by Microrubbing

Michinori HONMA and Toshiaki NOSE

A microrubbing technique is described that can form fine and arbitrary microscale liquid crystal (LC) alignment patterns. The fundamentals of the procedure and the optical properties of various planar-type LC optical devices fabricated using the microrubbing are reviewed. In particular, interesting and unusual polarization controlling properties of LC diffractive optical elements and their potential as polarization converters and polarization splitters are discussed.

Keywords : Liquid crystal, Diffraction grating, Liquid crystal grating, Blazed grating, Diffractive optical element, Liquid crystal diffractive optical element, Microrubbing

Control of Molecular Excited States by a Femtosecond Pulse-Shaping Method

Akihide WADA

A femtosecond pulse has a large spectral width and near-transform-limited characteristics due to its short duration. By applying the concept of Fourier transform to the femtosecond pulse, an arbitrary pulse shape can be formed from the femtosecond pulse. In other words, the pulse shaping technique introduces “timing” or “time sequencing” as the new controllable factor into photochemistry in which the wavelength and intensity of light were previously the major controllable factors. In this review, the general idea of the pulse shaping method, the control of excited state dynamics, and the optimized pulse shaping technique are briefly explained. The results of the optimized pulse shaping experiments are also reported.

Keywords : Pulse shaping, Quantum control, Coherent control, Optimization, Genetic algorithm, Excited state, Chemical reaction, Fourier transform