Special Issue List in Section

Characterization and Mechanics of Soft Materials
Guest Editors: Prof. Dr. Victoria Vitkova and Prof. Dr. Galya Staneva
Deadline: **30 April 2022**

Surface Modifications for Advanced Polymer Composites
Guest Editors: Prof. Dr. Francesco Branda and Dr. Aurelio Bifulco
Deadline: **10 May 2022**

The Wonderful World of Ionic Liquids and Deep Eutectic Solvents
Guest Editors: Prof. Dr. Annalisa Paolone, Dr. Giovanni Battista Appetecchi, Prof. Dr. Alessandro Triolo, Dr. Olga Russina and Dr. Anna Martinelli
Deadline: **20 June 2022**

Advances in Liquid Crystals
Guest Editor: Dr. Richard J. Mandle
Deadline: **10 September 2022**

100th Anniversary of Brillouin Scattering
Guest Editor: Prof. Dr. Seiji Kojima
Deadline: **20 November 2022**

Conducting Polymers: Structure Characterization, Conductivity, and Application
Guest Editors: Dr. Mark Žic and Dr. Marijana Kraljić Roković
Deadline: **20 December 2022**

Supercritical Fluids Technologies as a Basis for Development of Innovative Materials
Guest Editor: Dr. Mikhail G. Kiselev
Deadline: **20 December 2022**

Novel Materials Applied for Water Purification
Guest Editor: Prof. Dr. Qiliang Deng
Deadline: **20 January 2023**

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Section Editor-in-Chief

Prof. Dr. Jens-Uwe Sommer

Leibniz-Institut fur Polymerforschung Dresden e.V., Institute Theory of Polymers, Dresden, Germany

Interests: theoretical polymer and biopolymer physics; computer simulations in soft matter; statistical physics; polymers at interfaces; polymer networks; polymer solutions; polymer crystallization; polymers and nanoparticles

Section Information:

Soft matter is characterized by the key role of entropy and the great variety of phase transitions. As such soft matter forms the basis for future switchable and intelligent materials and devices. The research in soft matter covers among others polymers, liquid crystals, colloids, granular matter, hybrids and active matter, as well as wetting and friction phenomena, soft surfaces and interphases, gels, liquid-liquid phase transitions, and bio-mimetic systems. Due to the emergence of long time scales in many soft matter systems, meta-stability and non-equilibrium phenomena play an important role and can be harnessed in applications and processing. Novel applications and process engineering techniques require the understanding of the materials from the chemical building blocks up to the device level. This also involves numerical methods, computer simulations and emerging concepts of artificial intelligence and machine learning. To enhance our understanding of soft matter in the context of material science the section includes but is not limiting to contributions to

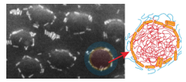
- Theoretical, computational and experimental studies of polymers, gels, colloids, wetting and friction phenomena, soft surfaces, active and biomimetic systems
- The understanding of phase transitions and phase behavior in soft matter
- The understanding of non-equilibrium and meta-stable states in soft matter including applications to device functions and processing
- Application of methods of artificial intelligence and machine learning in soft matter and soft materials, processing, and devices

Featured Papers

DOI: 10.3390/ma15082949

Assembly of Semiconductor Nanorods into Circular Arrangements Mediated by Block Copolymer Micelles

Authors: Riham Muzaffar-Kawasma, Meirav Oded and Roy Shenhar

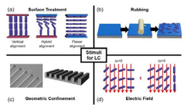


Abstract: The collective properties of ordered ensembles of anisotropically shaped nanoparticles depend on the morphology of organization. Here, we describe the utilization of block copolymer micelles to bias the natural packing tendency of semiconductor nanorods and organize them into circularly arranged superstructures. These structures are formed as a result of competition between the segregation tendency of the nanorods in solution and in the polymer melt; when the nanorods are highly compatible with the solvent but prefer to segregate in the melt to the core-forming block, they migrate during annealing toward the core–corona interface, and their superstructure is, thus, templated by the shape of the micelle. The nanorods, in turn, exhibit surfactant-like behavior and protect the micelles from coalescence during annealing. Lastly, the influence of the attributes of the micelles on nanorod organization is also studied. The circular nanorod arrangements and the insights gained in this study add to a growing list of possibilities for organizing metal and semiconductor nanorods that can be achieved using rational design.

DOI: 10.3390/ma13235466

Role of Stimuli on Liquid Crystalline Defects: From Defect Engineering to Switchable Functional Materials

Authors: Min Jeong Shin and Dong Ki Yoon

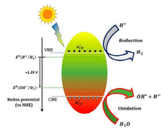


Abstract: Achieving tunable physical properties is currently one of the most exciting research topics. In order to realize this goal, a medium that is responsive to external stimuli and can undergo a change in its physical property is required. Liquid crystal (LC) is a prominent candidate, as its physical and optical properties can be easily manipulated with various stimuli, such as surface anchoring, rubbing, geometric confinement, and external fields. Having broken away from the past devotion to obtaining a uniform domain of LCs, people are now putting significant efforts toward forming and manipulating ordered and oriented defect structures with a unique arrangement within. The complicated molecular order with tunability would benefit the interdisciplinary research fields of optics, physics, photonics, and materials science. In this review, the recent progress toward defect engineering in the nematic and smectic phases by controlling the surface environment and electric field and their combinational methods is introduced. We close the review with a discussion of the possible applications enabled using LC defect structures as switchable materials.

DOI: 10.3390/ma14051055

Design of Chemoresponsive Soft Matter Using Hydrogen-Bonded Liquid Crystals

Authors: Huaizhe Yu, Kunlun Wang, Tibor Szilvási, Karthik Nayani, Nanqi Bao, Robert J. Twieg, Manos Mavrikakis and Nicholas L. Abbott

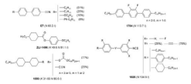


Abstract: In this study, we report the design of a nematic liquid crystal (LC) composition that forms through dimerization of carboxylic acids and responds to the presence of vapors of organoamines by undergoing a visually distinct phase transition to an isotropic phase. Specifically, we screened mixtures of two carboxylic acids, 4-butylbenzoic acid and trans-4-pentylcyclohexanecarboxylic acid, and found select compositions that exhibited a nematic phase from 30.6 to 111.7 °C during heating and 110.6 to 3.1 °C during cooling. The metastable nematic phase formed at ambient temperatures was found to be long-lived (>5 days), thus enabling the use of the LC as a chemoresponsive optical material. By comparing experimental infrared (IR) spectra of the LC phase with vibrational frequencies calculated using density functional theory (DFT), we show that it is possible to distinguish between the presence of monomers, homodimers and heterodimers in the mixture, leading us to conclude that a one-to-one heterodimer is the dominant species within this LC composition. Further support for this conclusion is obtained by using differential scanning calorimetry. It is possible to trigger a phase transition in the LC by exposure to volatile amines emitted from rotting fish. Overall, these results provide new principles for the design of chemoresponsive soft matter based on hydrogen bonded LCs that may find use as the basis of low-cost visual indicators of chemical environments.

DOI: 10.3390/ma15010157

On the Miscibility of Nematic Liquid Crystals with Ionic Liquids and Joint Reaction for High Helical Twisting Power Product(s)

Authors: Maciej Czajkowski, Joanna Feder-Kubis, Bartłomiej Potaniec, Łukasz Duda and Joanna Cybińska



Abstract: Mixtures of nematic liquid crystals (*LCs*) with chiral ionic liquids (*CILs*) may find application as active materials for electrically driven broadband mirrors. Five nematic liquid crystal hosts were mixed with twenty three ionic liquids, including chiral ones, and studied in terms of their miscibility within the nematic phase. Phase diagrams of the mixtures with *CILs* which exhibited twisted nematic phase were determined. Miscibility, at levels between 2 and 5 wt%, was found in six mixtures with cyanobiphenyl-based liquid crystal host—*E7*. On the other hand, the highest changes in the isotropization temperature was found in the mixtures with isothiocyanate-based liquid crystal host—*1825*. Occurrence of chemical reactions was found. A novel chiral binaphtyl-based organic salt [N_{1116}][*BNDP*] was synthesized and, in reaction to the *1825* host, resulted in high helical twisting power product(s). Selectivity of the reaction with the isothiocyanate-based liquid crystal was found.