Liquid Crystals Today

ISSN: 1358-314X (Print) 1464-5181 (Online) Journal homepage: http://www.tandfonline.com/loi/tlcy20

Research news

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To cite this article: Mamatha Nagaraj (2018) Research news, Liquid Crystals Today, 27:2, 41-41, DOI: 10.1080/1358314X.2018.1479162

To link to this article: https://doi.org/10.1080/1358314X.2018.1479162

LIQUID CRYSTALS TODAY
2018, VOL. 27, NO. 2, 41
https://doi.org/10.1080/1358314X.2018.1479162

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NEWS

Research news

Laser rewritable dichroics through reconfigurable organic charge transfer liquid crystals by M. V. winkle et al., Advanced Materials, 1706787 (2018)

Reconfiguring order and alignment of organic thin films is important for applications in self-healing materials. Bi-component columnar liquid crystals with donor–acceptor molecules have been tested for this purpose. These materials exhibit tuneable charge-transfer absorbance in the visible-NIR range. A recent paper in Adv. Mater. by Winkle et al. reports that an intense laser beam can be used to create user-defined patterns in dichroic and piezoelectric thin films of donor–acceptor columnar liquid crystals. The authors demonstrate noncontact writing and rewriting of barcodes by creating temperature gradients across the sample in thin films of charge-transfer liquid crystals. By changing the power and rate of laser movement, the magnitude of thermal gradient and cooling rates are tailored to obtain control over the loss or realignment of the polarisation axis for charge-transfer absorption on a micro-metre scale.

An unusual type of polymorphism in a liquid crystal by L. Li et al., Nature Communications, 9, 714 (2018)

Bent-core liquid crystals are well known for their unusual physical properties and exotic mesophases. Li et al. report a bent-core liquid crystal that forms two structurally and morphologically different liquid crystal phases; an oblique columnar phase and a helical filament phase. The formation of these phases depends on the rate of cooling from the isotropic liquid state. The helical filament phase is characterised to be a helical microfilament phase with pitch of the helix being fivefold larger than in helical nanofilament phases. The work demonstrates that the two structurally different mesophases have almost identical free energies such that they form when small differences in thermal history or concentrations are achieved.

Rotaxane liquid crystals with variable length: the effect of switching efficiency on the isotropic-nematic transition by H. He et al., The Journal of Chemical Physics, 148, 134905 (2018)

Liquid crystallinity in molecular switches consisting of topological linkages of two or more covalent structures is an interesting topic. The interlocked molecules are made in various shapes and forms. One of the examples is rotaxane or a wheel and axle molecule. He et al. report macroscopic changes in liquid crystalline phases of rotaxanes due to molecular switching between two states of the molecule. They present switching diagrams for four different switching scenarios to demonstrate the range of concentration and length ratio where optical changes occur by molecular switching. They considered a case where molecular switching is not quantitative and suggest that not all molecules in the solution need to be switchable in order to achieve a switchable phase change.

Stimuli-responsive hydroxyapatite liquid crystal with macroscopically controllable ordering and magneto-optical functions by M. Nakayama et al., Nature Communications, 9, 568 (2018)

Colloidal liquid crystals with particles of controlled anisotropic morphologies and sizes show new and interesting functional properties. Biocompatible colloidal liquid crystals are desired for applications in dental implants and cell culture scaffolds. Hydroxypatite (Hap) is a bio-friendly material and one of the main components in human bones and teeth. Nakayama et al., in their recent publication reports liquid crystals based on colloidal nanorods of Hap where the alignment of the nanorods can be controlled using external magnetic fields and mechanical forces. The nanorods were stabilised by poly(acrylic acid) and an unidirectional alignment of colloidal dispersions was achieved by mechanical shearing. Magneto-responsive functions were achieved with small magnetic anisotropy by using the dynamic behaviour of the isotropic-nematic biphasic regions.

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