

Nanocomposites and nanomaterials

Nano-structuring in highly viscous chiral LC compositions

A. Iljin¹, A. Gridyakina², H. Bordyuh²

¹ *Institute of Physics, NAS of Ukraine. Prospect Nauki, 46, Kiev 03039 Ukraine.
E-mail: lgtc@iop.kiev.ua*

² *National Aviation University. Prospect Komarova 1, Kiev 03058 Ukraine*

A novel type of chiral liquid crystalline materials – highly viscous compositions of non-crosslinked cholesteric liquid crystals (HVCLC), reveals unique very interesting features under a subtle deformation. Due to extreme responsiveness of the position of its photonic band gap the lasing, tuned in a wide range, has been realized in this system [1, 2]. The compositions were also shown to be applicable for novel sensors that are able to detect rotations well inferior to milliradians as well as submicron displacements with high accuracy and from a long distance [3].

The HVCLC systems discussed were obtained by mixing cyclic oligomers forming glassy state at room temperature and low molar mass compounds based on cholesterol derivatives. In addition to the high viscosity and viscoelasticity the composition exhibits unusual opto-mechanical properties and manifests nonlinear concentration dependence of its helical periodicity. The observed effect is suggested to be a result of formation of nano- and micro-clusters of cyclic oligomer molecules due to their physical bonding into coils. Such elastic “floating springs” influence the both optical and mechanical properties that could be useful for the electro-optical applications or opto-mechanical and deformation sensing.

1. *Shibaev P.V., Rivera P., Teter D., Marsico S., Sanzari M., Ramakrishnan V., Hanelt E.* Color changing and lasing stretchable cholesteric films // *Opt. Express.*-2008.-**16**.-P. 2965–2970.

2. *Shibaev P. V., Uhrlass R., Woodward S., Schlesier C., Hanelt E.* Cholesteric materials with photonic band gap sensitive to shear deformation and mechanical sensors // *Liq.Cryst.*-2010.-**37**.-P. 1601–1604.

3. *Shibaev P. V., Iljin A., Troisi J., Reddy K.* Distant optical detection of small rotations and displacements by means of chiral liquid crystals // *AIP Advances.*-2014.-**4**.-P. 017115-11.