Doping by chiral agent as a method to enhance electro-optic memory of "Liquid Crystal-Carbon Nanotubes" composites

S. Tomylko[1,2], T. Semikina[1,3], L. Dolgov[1], and O. Yaroshchuk[1],

[1]*Institute of Physics NASU, prospect Nauki 46, 03028 Kyiv, Ukraine,*
[2]*T. Shevchenko National University, Physical Faculty, prospekt Clushkova 2, 03022 Kyiv, Ukraine*
[3]*Institute of Semiconductors Physics, NASU, prospect Nauki 45, 03650 Kyiv, Ukraine*

Recently we described effect of electro-optic memory for suspensions of multiwalled CNT in nematic LC with negative dielectric anisotropy [1]. It consists in appearance of residual transmission of homeotropically aligned samples placed between a pair of crossed polarizers (Fig. 1a). The efficiency of the memory effect is characterized by the parameter $M=(T_{res}-T_0)/(T_{max}-T_0)$, where T_0, T_{max} and T_{res} are initial, maximal and residual values of sample transmittance T. The observed effect is caused by homeotropic to planar alignment transition of LC phase under the electric field. The field induced planar state is stabilized by the network of nanotubes formed from the fine parts of CNT phase dispersed by electro-hydrodynamic flows developing in the electric field.

We report now that memory efficiency M of LC-CNT composites can be enhanced by doping them with a minute amount of chiral agent. The studied composites were based on nematic mixture MLC6608, chiral dopant (ChD) S811 (both from Merck) and multiwalled CNT. The 16 μm layers of these composites were placed between two substrates containing ITO electrodes and aligning layers providing homeotropic LC alignment. Fig. 1 demonstrates electrooptic response of samples (a) LC-CNT (0.02 w%) and (b) LC-ChD(0.2%)-CNT(0.02%). The amount of CNT in these samples corresponded to maximal memory [1], while amount of chiral dopant was the maximal amount preserving homeotropic alignment. Comparing with LC-CNT sample, the sample doped with ChD demonstrates considerably higher residual transmittance T_{res} and, correspondingly, higher memory efficiency (M=0.82 vs. M=0.44). The observed enhancement of memory is explained by a poor stability of homeotropic alignment of LCs with helical structures. This strengthens planar state realized after electric field and so increases memory efficiency of the LC-CNT suspensions.

[1] L. Dolgov, O. Yaroshchuk, N. Lebovka, *Mol.Cryst.Liq.Cryst.*, **2008**, *496*, 212.