Nanocomposites and nanomaterials

Nanoparticles Cellular Network Formation Driven by Orientational Phase Transition in Liquid Crystal

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It is known that nanoparticles may drastically change structure and optical properties of liquid crystals (LCs). This nanoparticles effect is used for creating new LC materials and devices. Here we report on producing a stable network structure in a LC colloid initiated by the orientational transition from the isotropic phase to the nematic one. The LC colloid consisted of the LC matrix doped with nanocrystallites of a pigment [1]. The suspension was studied in the planar capillaries.

Being heated above the clearing point, $T_C = 43.1^{o}$C the suspension is optically homogeneous (insertion in Fig). Cooling the sample to room temperature results in formation of a cellular texture (Fig.). The set of the images of the cellular net at different distances from the capillary substrates is obtained. We find that the net is localized only at one of the substrates. It allows us to establish that the cellular net is comprised from the nanocrystallites adsorbed on the substrate.

We observe the changes of the suspension textures during the sample cooling from the isotopic phase to the nematic one. The transition to the nematic phase starts from formation of the nematic droplets, from which the nanocrystallites are expelled to the regions that remain in the isotropic phase. The following cooling of the sample results in enlargement of the nematic droplets and formation of the walls of the nanocrystallites in the contacts areas between the droplets. Increased concentration of the pigment in walls finally leads to the sedimentation and adsorption of the nanocrystallites onto the substrates and formation of the network structure on the substrate.

[1]. *A. Eremin et.al*., Adv. Funct. Mater., **21**, 556 (2011)