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Optical density and microstructure-related properties of photoactive nematic and cholesteric liquid crystal colloids with carbon nanotubes

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ABSTRACT

The optical density, microstructure and electrical conductivity in nematic (ZhK440, 5CB and their mixtures) and cholesteric (the mixtures of ZhK440, 5CB with chiral M5) colloids with single-walled carbon nanotubes (CNTs) were studied. The azoxy nematic ZhK440 is photoactive, and the effects of UV-irradiation and restoring irradiation were also investigated for the LC composites containing ZhK440. In the nematic mixtures ZhK440 + 5CB anomalous behaviour of optical density and electrical conductivity close to the compensation point of dielectric anisotropy was observed. It was speculated that CNTs can increase the tendency towards nematic ordering of LC molecules and destroy the intermolecular complex by preferential adsorption of 5CB molecules on the surface of CNTs. In cholesteric mixtures of ZhK440+ M5, the optical density vs. CNT concentration $D(C_n)$ dependences were markedly non-monotonous, with a pronounced maximum and minimum. For these composites, UV-irradiation resulted in shifting the location of these extremums. The effects were explained accounting for interactions between cholesteric oily streaks and CNT networks, localisation of CNT inside the cholesteric defects, impact of CNTs on the structure of defects, and impact of cholesteric medium on the structure of CNT aggregates, their compactness and shape anisometry.

Keywords: Carbon nanotubes; Photoactive nematic and cholesterics; Electrical conductivity; Optical density Liquid crystal colloids;

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