Enhanced magneto-optical properties of colloid of ellipsoidal mono-dispersed nano-particles in liquid crystal

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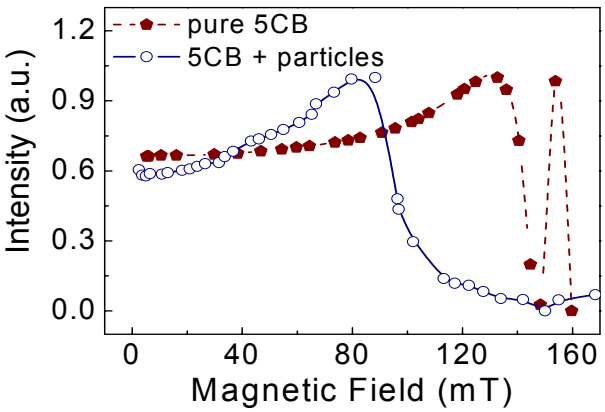
Diluted liquid crystals (LC) colloids of nano-particles are of great interest due to possibility of enhancing the nematic LC properties. We explore how to increase LC sensitivity to external fields, namely to the magnetic one. For this purpose, we formed colloids consisting in a mixture of LC 5CB and ellipsoidal mono-dispersed iron oxyde nano-particles (size about 300x50 μm) at concentrations smaller than 10^{-2} wt %.

To check sensitivity of new obtained colloids to magnetic field, the measurements of magneto-optical properties were made. Fréedericksz transition in the magnetic field of the pure LC and colloids were measured and compared. Symmetric LC cells (cells thickness was 50 μm) with planar boundary conditions and strong anchoring were used for the experiments. The cells were filled with either pure LC or colloids at room temperature. The filled cell was placed between crossed polarizers in the magnet. The angle between LC director and the bias-field (H_B=0.5 mT) direction was 0°, and the angle between the director and the test-field was 90°. The cells were tested with a laser diode, whose polarization was set at 45° to director in the cell.



The Fréedericksz transition threshold for colloid appeared to be lower than that for pure LC. This fact shows that addition of magnetic nano-particles in liquid crystals, which forms colloid, influences the LC properties. The determined magneto-optical characteristics of the colloid proved to be significantly increased comparing to corresponding properties of the nematic matrixes.

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