The Effect of Magnetic Nanoparticles on the Optical Properties of Liquid Crystals

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Abstract. By integrating nanoparticles with magnetic properties into liquid crystals their properties can be tuned to increase or decrease their behavior under external magnetic fields. Synthetized nanoparticles shapes and various concentrations defines their interactions with liquid crystal host. An investigation of colloidal stability and structural changes in host liquid crystals is presented, considering the effects of external magnetic fields on various liquid crystals (LCs) and dopands. A distinctive difference in light transmission responses was observed in studied nematic LC (NLC) samples as compared to undoped liquid crystals. Nanoparticle magnetic moments and the NLC director are coupled into an orientational relationship, which is indicated by both structural changes and orientational coupling. As magnetic fields increased linearly, we examined the magnitude of structural changes and their stability. NLC compounds were found to behave differently as a result of magnetic nanoparticle size and concentration analyzed through light transmission characteristics. The obtained results showed the lowering of the threshold magnetic field with an increase in the concentration of nanoparticles and size. In addition, they showed the critical role of nanoparticle size in stability and switching properties. Moreover, the data revealed that the effect of size was more significant than the effect of concentration for the considered range.