Nanocomposites and nanomaterials

Magnetic Actuation of Thermodynamically Stable Colloid of Ferromagnetic Nanoparticles in a Liquid Crystal

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Magnetically actuated liquid crystal (LC) devices are extremely promising for modern optics applications from the viewpoint of the instantaneous response to, and the contactless nature of, magnetic manipulation, and because of the increased versatility of employing magneto-electro-optical effects in LCs. The promising way for increasing the magnetic susceptibilities of LC materials is dispersion of magnetic nanoparticles (NPs) in a conventional LC host matrix; however, the application of such nanomaterials is constrained by very low stability, which is a direct result of NPs aggregation in the LC phase.

We report the development of highly stable nanomaterial based on ferromagnetic nanoparticles dispersed in a thermotropic liquid crystal (fig. 1). The long-term colloidal stability and homogeneity were achieved through surface modification of the nanoparticles with mixture of dendritic oligomesogenic surfactant and hexylphosphonic acid (fig. 1) and confirmed by optical and electron microscopy. The nanomaterial has an increased sensitivity to the magnetic field possessing collective and non-collective magneto-optical responses in contrast to the undoped LC. The effective coupling of the spherical particles with the LC director is due to the arrangement of the nanoparticles in chains.

Figure 1. Photos of 1 wt % colloids in E7 of $CoFe_2O_4$ nanoparticles stabilized with oleic acid/oleylamine (a) and with ligands mixture **1**/**HPA** (b).