The synthesis and investigation of macro-chiral liquid crystal nanoparticles

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Metal nanoparticle (NP) functionalized liquid crystal (LC) materials are attracting considerable attention due to their potential applications in magnetic, optical and electronic devices. The optical properties of these NPs are often related to the 2D and 3D organisation of such materials. Research on the organic groups for such systems has in the past concentrated mainly on the type of the mesogenic groups selected and to some extent on the functional groups linking the NPs and the mesogens. Chiral group functionalized NPs have been studied for mixtures in LC systems for the induction of chiral phase behaviour in nematic hosts and to a lesser extend for the formation of chiral LC structures. [1, 2] The question, whether LC and chiral group functionalized NPs can modify and amplify the chirality of organic ligands in composition with LC hosts has not been explored in detail. [3] Here we report the results of the synthesis of gold NPs in the size regime from 3-5 nm functionalized with ligands based on the binaphthol motif and with nematogenic groups. [4] The materials were characterised chemically and the ratios between chiral groups and LC groups was determined. The LC properties were determined by optical polarizing microscopy (OPM) and differential scanning calorimetry (DSC) and by synchrotron based XRD studies. Based on these results, phase diagrams with nematic hosts were constructed. For a number of selected mixtures the helical twisting power (htp) of these systems in nematic hosts was determined. The experimental data shows that the htp of the investigated chiral LC Au NPs (C_LC_Au_NPs) is significantly larger than that of the chiral groups dispersed in the LC host and larger than that of NPs functionalized only with chiral groups. The LC properties of these systems will be discussed and will be compared to structurally related materials.

References

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