Nanoparticle/Liquid crystal hybrids based on hydrogen bonding interactions

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Nanoparticle/liquid crystal (NP/LC) composites [1] are being developed based on hydrogen bonding. Hydrogen bonding, a relatively strong non-covalent interaction, can promote stability, yet is still reversible, allowing the annealing of defects. Metal oxide NPs that offer thermally stability, a facile surface functionalization and enhancement of the LC electro-optical properties are being explored for this purpose. Monodispersed ZrO2 nanocrystals, synthesized by a non-aqueous hydrolysis method, [2] have been dispersed into benzoic acid based LCs. In the case of functionalized NPs, hydrogen bonds can form between pendant COOH groups and LC host molecules. Initially the interaction between hexylbenzoic acid (6BA) and non-functionalized ZrO2 NPs was investigated since these NPs can be stabilized with long chain carboxylic acids. Alkanoic acids are known to strongly bind to zirconia via a chelating bidentate zirconium carboxylate surface bond. [3] Dispersions were prepared by directly adding NPs dispersed in THF to isotropic 6BA (T_{CN} = 97 °C, T_{NI} = 113 °C). TEM images indicate that the NPs are uniformly dispersed with surface-surface interparticle spacings on the order of twice the 6BA molecular length (1.86 nm in average) although some aggregates are observed. (Fig. 1) POM images show an undisturbed Schlieren texture, however the transition temperatures are significantly lower (T_{CN} = 93 °C, T_{NI} = 109 °C).

Fig. 1. From left to right: POM image of 0.1wt% doped 6BA with ZrO2 NPs; TEM images with ~580Kx magnification, respectively

References:

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