Temperature-driven luminescence switching of europium(III) in a glass dispersed liquid crystal film

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Dispersed liquid crystal displays are a more recent type of LCD and involve micrometer-sized droplets of a nematic liquid crystal in a solid, isotropic matrix.¹ Polymer dispersed liquid crystals are now well studied. The sol-gel process can be used for preparing films of Glass Dispersed Liquid Crystals (GDLCs).² The glass films have dispersed liquid-crystalline droplets with a diameter varying between 1 and 180 μm .

Here, a simple type of GDLC was used to test the application of lanthanide-doped luminescent GDLC films. The samples were prepared by a sol-gel synthesis starting from tetraethyl orthotitanate, an amine functionalized organoalkoxysilane and water. The incorporation of a liquid crystal (5CB) in the sol-gel film and the solubility of a europium(III) β -diketonate complex in this matrix was tested. The variation of the luminescence intensity of a europium(III) complex as a function of the temperature was recorded.

Figure 1: The relative intensity change of the $^5D_0 \rightarrow ^7F_2$ transition during heating and cooling a glass dispersed liquid crystal film doped with a europium(III) β -diketonate complex.

The liquid crystal in the nematic phase scatters incident light very strongly. In a GDLC film the droplets containing liquid crystal cause the whole sample to be turbid. UV-light was used to excite the luminescent compound. Due to the large internal scattering of the UV-light in the nematic phase the absorption by the luminescent dopand is enhanced, thus giving the layer a visible red color. When the

film is heated above the clearing point, the refractive index of the isotropic liquid becomes similar to the refractive index of the glass. The UV-light passes through the layer with less absorption, and thus less luminescence light is produced. A strong change in the luminescence intensity was observed at the nematic-to-isotropic transition.

References

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