

Characterisation of Electrical Behaviour of Confined Liquid Crystal Through Thermophysical Study of Polymer-Dispersed Liquid Crystal (PDLC)

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The thermophysical properties of polymer-dispersed liquid crystal films made of monodisperse polystyrene (PS) and 4-*n*-pentyl-48-cyanobiphenyl (5CB) are investigated by a photothermal technique. In their most common form, PDLC films consist of low molecular weight liquid crystals (LC) dispersed as micrometer-sized droplets within a solid polymer matrix. Among the main aspects governing the thermal properties, of these materials are the concentration of LC, the morphology of the films, the anchoring conditions of the LC at the polymer interface. The behaviour of the thermal conductivity of the composite in alternating electric field is intimately linked with the orientation of molecules in LC droplets. At zero fields, the symmetry axis of each LC droplet in the nematic phase varies randomly and for the heat entering the film, the effective thermal conductivity is reduced. At high fields, each droplet's symmetry axis is aligned with the external field which is parallel to the heat flow. The thermal conductivity of the droplets increases leading to a rise in the effective thermal conductivity of the PDLC film. It has been shown that the orientation of the LC molecules confined in the droplets is also dependent on the driving field frequency. In the vicinity of the low frequency domain an interfacial polarization process resulting from a charge accumulation at the droplet-polymer interface may occur resulting in a lower electrical field in the droplet. In this work we have used the photopyroelectric technique to study the evolution of the thermal properties of these systems when applying an electric field. We have studied the effect of the temperature, the LC concentration and the driving field frequency on the effective thermal conductivity of the composite.