

ABSTRACT

An Electric Field Investigation Of The Optical Activity For Two Chiral Nematic Liquid Crystals Of The Same Homologous Series

Sherika Nikara Robinson

The work done in this thesis deals with the investigation of the isotropic \rightarrow cholesteric phase transition for the mixture of two chiral liquid crystal compounds, nonanoic acid [(3S,8S,9S,10R,13R,14S,17R)-17-[(1R)-1,5-dimethylhexyl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthren-3-yl] ester (Cholesteryl Pelargonate) and octadecanoic acid [(3S,8S,9S,10R,13R,14S,17R)-17-[(1R)-1,5-dimethylhexyl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthren-3-yl] ester (Cholesteryl Stearate).

This investigation was done by use of optical activity techniques and also incorporated in this study is the application of an increasing electric field to each sample investigated. For each sample the concentration of the two compounds was varied; this allowed for the chirality to vary without compromising the other material parameters of the compounds.

A rotating analyser method was used to obtain optical activity measurements. This approach has been used previously and has been instrumental in determining the nature of the Isotropic \rightarrow blue phase III (BP III) transition. From the data obtained transition temperatures were determined for the samples of each compound examined.

The Landau deGennes theory was tested for the data gathered. In addition the temperature dependence equation was used to gain the transition temperatures for the pure samples with and without an applied voltage.

From this work it was found that electric fields induce new blue phases as well as stabilise blue phase I. The transitions from the isotropic to blue phases become more continuous with increasing electric fields.

The electric fields also induced a helix inversion in the pure octadecanoic acid [(3S,8S,9S,10R,13R,14S,17R)-17-[(1R)-1,5-dimethylhexyl]-10,13-dimethyl-2,3,4,7,8,9,11,12,14,15,16,17-dodecahydro-1H-cyclopenta[a]phenanthren-3-yl] ester (CS) sample.

Keywords: Optical activity; Chiral liquid crystals; Transition temperatures; phase transitions; electric fields; blue phases