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THERMOACOUSTIC STUDIES IN ALKENYL LIQUID CRYSTALLINE COMPOUNDS

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Abstract

Density of the liquid crystals can be measured by using a specially constructed sensitive dilatometer having two uniformly bored capillary arms of length around 30 cm above the bulb The volume of the dilatometer bulb and the volume of the capillary bore per cm were determined by calibrating it with triple distilled water, benzene and mercury and found to be 3.12916 cc and 0.00951 cc/cm respectively. The levels of the fluid in both capillary arms were recorded by using two traveling microscopes of least count 0.001 cm. The temperature variations of the volume of the dilatometer were recorded and corrections were made for it. All the weighing were done on sensitive K.Roy analytical single pan balance of sensitivity 0.00005 gm. The dilatometer was placed inside the INSREF solid state temperature bath and the temperature was controlled to an accuracy of ± 0.1°C for making measurements at various temperatures.

Key words: Alkenyl liquid crystal, Dilatometer, Distilled water and Traveling microscope

INTRODUCTION

The thermo acoustic parameters of liquid crystals play an important role in understanding the significance of microscopic factors such as molecular order, molecular cohesion, intermolecular interactions, the internal structure, and anharmonicity. Over the past decade, a great deal of work has been carried out in the evaluation of thermo-acoustical parameters. Several approaches have been proposed to evaluate the parameters for a wide variety of liquids, polymers and liquid crystals. Some of these parameters are of fundamental significance in the equation-of-state calculations which serve as an effective guide in determining the mechanism of

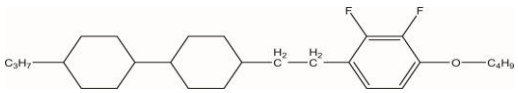
ultrasonic absorption in liquids and in establishing a correlation with the results of phonon-phonon interaction absorption[1].

The liquid crystalline state is characterized by the oriental ordering of its constituent molecules and transitions between different mesophase are accompanied by changes in the local molecular order. These transitions depending on the local order may also be accompanied by changes in scalar quantities such as enthalpy content or density**.** Several observations[2, 3] revealed that at a particular temperature a flow anomaly was noticed in nematic liquid crystals and also a discontinuous change in thermal expansivity. In view of this, specific volume and thermal expansion studies in the nematic and isotropic phases of some liquid crystals have been considered.

It is well known that structures of the rigid core of liquid crystal molecules strongly affect the physical properties of mesogens. It has been found that the introduction of a double bond at specific side chain position also markedly affect the material properties of liquid crystals[4]**.** In this chapter, an attempt has been made to study the coefficient of volume expansion (α) and thermoacoustic parameters of the three three fluorinated liquid crystalline compounds which have nematic phase over a wide range.. The densities of these compounds are measured with the variation of temperature and from that coefficient of thermal expansion (α) are calculated. Based on these, the thermoacoustic parameters of these compounds are calculated.

The structures of the three fluorinated liquid crystalline compounds used are given below[5].

1



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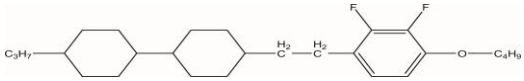

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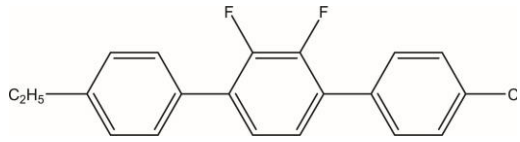

DETERMINATION OF TRANSITION TEMPERATURES - THE POLARIZING MICROSCOPE

The transition temperatures of the above compounds were determined using polarizing microscope in conjunction with a conventional hot stage[6]. The microscope for the examination of transparent and opaque

objects with all known methods of illumination and optical contrasting is called polarizing microscope. Facilities for rapid extension and adaptation to the problem to be solved have been incorporated in this instrument as basic feature. The Leitz orthoplan - pol is one of the important variants equipped for the observations and measurements of isotropic and anisotropic specimen in polarized transmitted and incident light.

The specimen of thickness 30 to 50μ is taken in between the slide (7.5 cm x 2.5 cm) and the cover slip. The specimen was melted in between these two and sealed by araldite or with epoxy cement. The prepared slide is kept on a specially constructed hot stage with temperature controller unit for examination under a Leitz polarizing microscope. The temperature of the specimen was varied across the transition points at the rate of 0.1°C per minute. Measurements were made using a calibrated thermometer graduated at the interval of 0.1°C. The bulb of the thermometer was kept close to the specimen in order to ensure that there was no lag between the observed actual temperatures.

EXPERIMENTAL DETERMINATION OF THE DENSITIES OF LIQUID CRYSTALS

The density of the liquid crystals can be measured by using a specially constructed sensitive dilatometer having two uniformly bored capillary arms of length around 30 cm above the bulb (Fig. 3.1). The volume of the dilatometer bulb and the volume of the capillary bore per cm were determined by calibrating it with triple distilled water, benzene and mercury and found to be 3.12916 cc and 0.00951 cc/cm respectively. The levels of the fluid in both capillary arms were recorded by using two traveling microscopes of least count 0.001 cm. The temperature variations of the volume of the dilatometer were recorded and corrections were made for it. All the weighing were done on sensitive K.Roy analytical single pan balance of sensitivity 0.00005 gm. The dilatometer was placed inside the INSREF solid state temperature bath and the temperature was controlled to an accuracy of ± 0.1°C for making measurements at various temperatures.

RESULTS AND DISCUSSION

The temperature dependence of the coefficient of volume expansion of the liquid crystals is utilized for the evaluation of different thermodynamic and anharmonic parameters. The density, specific volume, coefficient of volume expansion and the thermoacoustic parameters estimated

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