Study of physical properties associated with some binary mixtures of chiral ferroelectric liquid crystalline compounds

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Abstract:

Study of physical properties associated with some binary mixtures of chiral ferroelectric liquid crystalline compounds

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Abstract

Among the various advanced technological materials in the modern era; Liquid Crystals (LCs) has become one of the most important self-organizing molecular materials with their growing applications in the various field of science. The research associated with the Ferroelectric Liquid Crystals (FLCs) has become a subject of most intense area during the past few decades owing to their valuable intrinsic fundamental properties.At present their successful utilization in flat television screens, fast electro-optical switching devices etc. makes them extremely demandable in the commercial field. The fulfilment of this promise depends greatly on an improved understanding on the physical properties of the FLC materials. However no single materials can exhibit all the desired properties for different applications. In order to fulfil all the requirements of the device manufacturer; preparation of suitable binary mixtures is one of the most simple and elegant way in the field of LC Research. Keeping this in mind some mixtures have prepared by using pure chiral FLC compounds [1,2,3] and investigated in the light of the static dielectric permittivity (ε), dielectric anisotropy (Δε), spontaneous polarization (P_S), response time (τ), torsional bulk viscosity (h) and dielectric spectroscopy. The temperature variation of P_S of the studied mixtures provides a preliminary idea about the order of the associated phase transitions namely SmA*-SmC* and N*-SmC*. The activation energy of all the mixtures have been determined from the best fitted Arrhenius plot. This assignment mainly contributes to the preparation and investigation of some smart multifunctional FLC mixtures aimed for optoelectronic and photonic applications.

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Keywords: Static dielectric permittivity; Dielectric anisotropy; Spontaneous polarization; Critical exponent (β); Response time; Torsional bulk viscosity; Activation energy.

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Comments on this paper

Charles Rosenblatt
13 November 2020

ITO effect

Thank you for the paper. I read through the powerpoint slides, which contain useful physical property information on these mixtures. I am perplexed by the "ITO mode". I see the consequences of this mode, especially in the high frequency dielectric data, but do not understand where this comes from or why it is called the ITO mode. Perhaps you can explain? Also, do you see any physical behavior that is not some average of the two components, but rather due to some complex interaction between the two components in the mixtures? Thanks.

BARNALI BARMAN
15 November 2020

Thank You for the comment,
One can observe some contribution for high frequency part of the dielectric spectrum, due to non−zero resistivity of electrode material or non−zero inductivity of connecting wires. At a higher frequency regime (~ few MHz) some relaxation process was found which is attributed due to the finite resistivity of (Indium Tin Oxide) ITO layers present in measuring cells (in which liquid crystals are filled) that is why so named. For more information about ITO effect one can read the following references.
There is no indication of such behaviour which arises due to the complex interaction of the two components of the binary mixtures in our observation.

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