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SPECTROSCOPY OF NANO CELLULOSE DOPED WITH POLYMER DISPERSED LIQUID CRYSTAL

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ABSTRACT

The main focus of research involved in the absorption spectroscopy of Nano cellulose doped polymer dispersed liquid crystal (PDLC). The nanomaterials doped PDLCs materials have superior performance relative to conventional PDLCs materials due to their high strength and high polymer stiffness in polymer reinforcement. Nano cellulose doped PDLC with different composition have been investigated by means of UV/VIS (Ultraviolet- Visible Spectroscopy) studies. A homogeneous solution of Poly (methyl methacrylate) (PMMA) and nematic Liquid Crystal (5CB) was prepared by Ultra sonication to achieve miscibility and Nano cellulose was doped using solution induced phase separation technique.

Results were interpreted in terms of infrared absorption spectrum, optical properties and solubility of Liquid Crystal in the polymer matrix.

Keywords: Spectroscopy**,** PDLC, PMMA, Nano cellulose, absorption spectrum,Ultra sonication, SIPS.

1. INTRODUCTION

The interaction between polymer surfaces and Liquid Crystal (LC) is an attractive subject for Fundamental research and it also plays an essential role in the operation of many Liquid Crystal based devices. The present study relates to a LC film of Nano Cellulose and its application in particular to a Nematic LC.Nano Cellulose, one of the most versatile and widely found biopolymers innature exhibit pseudo-plastic behaviour under normal conditions and becomes thixotropic when stressed. The main focus of our research carried out was to utilize the enhanced properties of Nano Cellulose Nano Crystals (CNCs) to develop novel cellulose-based materials with diverse advanced functionalities. Method used for Liquid Crystal phase characterization and identification of various mesophases is Ultraviolet- Visible (UV-VIS) Spectroscopy, to determine the absorption spectrum present in the compounds that absorbs in Visible – UV part of spectra. Various specialised techniques, such as Solvent Induced Phase Separation (SIPS), ThermallyInduced Phase Separation (TIPS), Polymerization Induced Phase Separation (PIPS), and Encapsulation are being used to prepare Polymer Dispersed Liquid Crystal (PDLC).

In this study, we used SIPS method where LC and polymer is dissolved in a common solvent (Toluene) to create a single phase, so as to dope Nano Cellulose in different proportions (20%, 25 %, 30%, 35%, and 40%) by mass. These doped samples are investigated in the range 200 nm to 600 nm.

2. MATERIAL AND METHODS

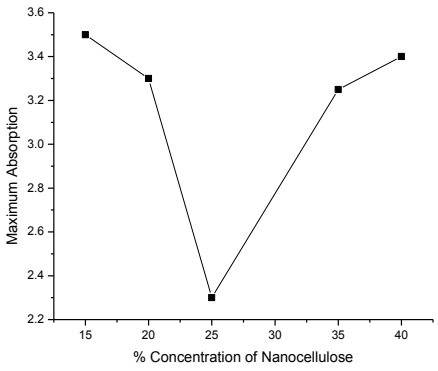
The preference of choosing 5CB is due to its broad nematic range (18°C to 35°C). The nematic–isotropic transition of 5CB occurs at Nematic–Isotropic Transition (TNI) = 35°C.The Monomer was Methyl methacrylate (MMA). It polymerizes easily to form Poly (methyl methacrylate) PMMA. The doping material was Nano Cellulose, size ranging from 20-50 nm in fluid state.

For preparation of PDLC, we used SIPS method. This process requires both the liquid crystal and monomer to be dissolved in a solvent. The

solvent is then removed (typically by evaporation) at a controlled rate to begin the phase separation. A homogenous mixture of 5CB (70%) – MMA (30%) was prepared in Toluene (Solvent) and NanoCellulose was doped with different proportions by mass (15%, 20%, 25%, 35%, 45%). The solutions of different concentrations were sonicated for 30 minutes in order to achieve Miscibility. These uniform solution were studied in the ultra violet visible spectral region.

3. RESULTS AND DISCUSSION

Increasing % of Nano cellulose in the mixture resulting in the absorption of UV-Vis graph is shown below.



This graph indicates that absorption drops from 3.5 at 15% to a value point of 2.3% at 25% Nano cellulose further increase in leads to increasing value of absorption touches peak ~3.25 at percentage of ~35% Nano cellulose. The absorption drops further as the percentage of Nano cellulose is increased in the doped sample.

4. CONCLUSIONS

It is to be noted here that such a study has been carried out for IST time with the novel idea of doping a polymer based sample (PDLC) with a biological sample viz.; Nano cellulose.

We further project to carry our research on such samples using various techniques to bring about a co-relation from biological point of view.

5. ACKNOWLEDGEMENT

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