

DECLARATION

I declare that the thesis entitled “**Formulation and characterization of room temperature ferroelectric and antiferroelectric liquid crystal mixtures**” has been prepared by me under the guidance of Dr. Pradip Kumar Mandal, Professor, Department of Physics, University of North Bengal. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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I certify that Mr. Asim Debnath has prepared the thesis entitled “**Formulation and characterization of room temperature ferroelectric and antiferroelectric liquid crystal mixtures**” for the award of Ph.D. degree in Science of the University of North Bengal, under my guidance. He has carried out the work at the Department of Physics, University of North Bengal. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

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PREFACE

The present dissertation entitled “**FORMULATION AND CHARACTERIZATION OF ROOM TEMPERATURE FERROELECTRIC AND ANTIFERROELECTRIC LIQUID CRYSTAL MIXTURES**” is submitted to fulfil the requirements for the degree of Doctor of Philosophy (Science) of the University of North Bengal. This thesis embodies the results of investigations on how various dopants differing in structures as well phase sequences when doped in an achiral host or in a multi-component host matrix can influence the mesomorphic behaviour critically important for electro-optical properties of the liquid crystal display devices. The work presented in this thesis will be a useful guide to design liquid crystal mixtures with good properties for display devices. All the studies presented in this dissertation have been carried out in Liquid Crystal Research Laboratory, Department of Physics, University of North Bengal under the supervision of Prof. Pradip Kumar Mandal, Department of Physics, University of North Bengal, Siliguri-734013. Only synchrotron X-ray diffraction study has been performed in Deutsches Elektronen Synchrotron (DESY), Hamburg, Germany. The thesis consists of seven chapters. A brief introduction to liquid crystal is given in **Chapter 1**. **Chapter 2** contains the basic theory and experimental procedures followed for characterizing different liquid crystal materials and their mixtures. List of investigated compounds are also given in this chapter. Formulation and characterization of total 19 liquid crystal mixtures useful for display application has been presented in the thesis. **Chapter 3** describes the formulation and characterization of six binary mixtures (**M1-M6**) by using a biphenyl benzoate ester with oligomethylene spacer based non-flourinated chiral compound (**DP1**) as dopant and a three ring pyrimidine compound (**H5**) as host. The low temperature SmB* phase could be suppressed by mixing **M4** in a pyrimidine based four component achiral host matrix (**HM**) resulting mixture **M7**. In **Chapter 4** effect of a non-mesogenic chiral terphenyl dopant (**DP2**) on multi-component host matrix has been described by formulating six mixtures

(**M8-M13**). Effect of an oligomethylene spacer based partially fluorinated chiral dopant which exhibit only SmC* phase (**DP3**) on **HM** was studied in a mixture **M14** and obtained results are presented in **Chapter 5**. The effect of SmC*_A-SmC*- SmA* phase sequence and molecular structure of four partially fluorinated compounds **DP4**, **DP5**, **DP6**, **DP7**, which differ only in the number and position of fluorine atoms in the benzoate ring of the molecular rigid core, on the multi-component **HM** is described in **Chapter 6**. Out of the four mixtures (**M15-M18**) two exhibited extended antiferroelectric phase while the other two exhibited only enhanced ferroelectric phases. **Chapter 7** describes the formulation and characterization of a wide range room temperature electroclinic mixture (**M19**) with dopant **DP6** and the **HM** having large induced tilt and very small layer concentration. **Chapter 8** sums up the conclusions of this research work. A list of selected books and monographs on liquid crystals and datasheet of some commercial liquid crystal mixtures has been listed **Appendix A**. All the results incorporated in this dissertation have been published in different scientific journals and also presented in different conferences and seminars, a list of which is given in **Appendix B**.

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