Abstract

This thesis reports the results of the X-ray diffraction experiments throughout the mesomorphic range of eight liquid crystal samples and the dielectric constant measurements on three samples. Chapter 1 (General Introduction) discusses classification, molecular structures, the mean field theories (MS and HJL) of the nematic liquid crystalline state and applications of liquid crystals. Chapter 2 gives the description of the samples studied and of the experimental set up for X-ray diffraction. Chapter 3 covers the theoretical background while the elaborate procedure for the calculation of orientational distribution function, order parameters, co-efficients of pseudopotential, intermolecular distance and the layer thickness/apparant molecular length from X-ray experiments are given in chapters 2 and 3. Six of the eight samples could be oriented in magnetic fields; for these samples, the experimental order parameters have been compared with those obtained from simple mean field theory and the experimental orientational distribution functions have been compared with those obtained from the calculated pseudopotential retaining the P_2 term only as well as with those obtained from the pseudopotential retaining both P_2 and P_4 terms. The layer spacings/apparant molecular lengths have been compared with lengths obtained from molecular models in order to get informations regarding molecular arrangements. All these results (from X-ray experiments) are given in chapter 4. The purpose of the dielectric

constant and the dielectric anisotropy measurements was to calculate the dipole moment, and the angle between the molecular long axis and the direction of the resultant dipole moment of the molecule. The effort was, however, less successful in this case. The theoretical background, experimental set up, results of the dielectric measurements are reported and discussed in chapter 5. The last chapter (Chapter 6) summarises the main results of the whole work.