Abstract

The energy and information content carried by an optical beam can split into two optical paths when the beam transmitted through a birefringent crystal corresponding in general to two different components: the ordinary and extraordinary directions. Assuming a uniaxial crystal with its optic axis oblique to the surface of incidence, the directions of refraction are distinct. Therefore, an object placed in front of the crystal when imaged through an optical system results in two shifted images.

Optical polymers and liquid crystals which exhibit birefringence have been widely used in industrial and research applications as key materials for various optical devices such as lenses and functional films for liquid crystal displays (LCDs).

In the first chapter, a general introduction was introduced about the phenomena of birefringence, speckle photography and liquid crystal material. After that the previous work that appeared in these fields were mentioned. Aim of the work had been identified at the end of the chapter.

In the second chapter, the values of birefringence and dispersion for quartz, calcite crystals and Fortepan photographic plate were measured by using advanced techniques of speckle photography and two

beam interferometry. The values of birefringence for these samples were measured and compared with another polarizing method depending on the intensity of incident and transmitted light from the sample.

Liquid crystal (LC) state is a distinct phase of matter observed between the crystalline (solid) and isotropic (liquid) states. Liquid crystals were found to be birefringent, due to their anisotropic nature. Liquid crystals can be classified into two main categories: thermotropic and lyotropic liquid crystals. Thermotropic LCs exhibit a phase transition into the LC phase as temperature is changed, whereas lyotropic LCs exhibit phase transitions as a function of concentration.

In the third chapter, the values of refractive indices at different wavelengths and different degrees of temperature were determined using Abbe refractometer and UV-visible spectrophotometer for new thermotropic liquid crystals. Also birefringence at different wavelengths and different degrees of temperature were measured for these thermotropic liquid crystals by using new speckle photographic technique.

In the fourth chapter, the values of refractive indices at different wavelengths and different concentration were determined for new lyotropic liquid crystals using Abbe refractometer and UV-visible spectrophotometer. Birefringence at different wavelengths and different concentrations for these lyotropic liquid crystals were measured by using Abbe refractometer and the speckle photographic technique.

In the last chapter, a detailed discription of the devices used in measurements were illustrated followed by conclusions offering the findings of the entire study.