Study of the optical and physical roles of a dielectric laser dye solvent which affects on the dye laser operation

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It is well known that when the pump laser beam incidence on the laser dye liquid it well be absorbed. This absorbation tends to heat the laser active medium which is the laser dye solution. In view of this the correlated properties of that active medium well change tending to shift the operated frequency and wavelength. Therefore, one of most interested dielectric, nonpolar, laser dye solvent was selected for this investigation which is ethylacetate. A laser interferometer known as Mach-Zhender interferometer (MZI) was constracted and used to measure the refractive index of the investigated solvents by counting the interferring fringes as a function of the angle of incidence of the incident laser beam. The temperature of that solvent was raised within the range 293 – 373K by using a constructed heating system. The thermal behavior of the refractive index of ethylacetate was studied to estimate the thermo-optical coefficient of the refractive index which is important to know the state convegence or divergence of the pump laser beam within the laser dye medium. Also, the dielectric constant of the dye solution is an important parameter for the laser operation. Therefore the dielectric constant and its thermal behvior of ethylacetate was calculated through the MaxwellŠs relation to determine the thermal coefficient of the dielectric constant. The value of the number density of the investigated solvent was estimated by using the obtained values of the refractive index and its variation with the temperature was studied. Because the dependence of polarizability on the dielectric constant through the Lorentz-Lorenz formula the values of both polarizability and its thermal behvior were studied showing a constant behvior. In addition, since the refractivity depends on the polarizability the value of it was determined. By using the values of polarizability the molecular radius was determined and using the Clausius-Mossotti relation the actual volume occupied by all molecules per unit volume was estimated. The volume expansion, through Murphy and Albert equation was calculated.

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