Birefringence dispersion in uniaxial material irradiated by gamma rays cellulose triacetate films

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Abstract

Cellulose triacetate, CTA, as a uniaxial material, has many diverse scientific and technological applications. These applications depend basically on the optical properties of the material. In this paper, a simple two-beam interferometric technique is used to measure the absolute (built-in) birefringence in cellulose triacetate film plates. By a least squares fitting to the Cauchy dispersion formula, the quantum parameters of CTA are deduced. The dispersion of the induced-birefringence due to gamma irradiation, at the visible region of the spectrum, is determined. The relative error in birefringence is $5 \times 10{-}3$. It is found that the birefringence is inversely proportional to the wavelength and its rate of increase is greater at shorter wavelengths. As the gamma irradiation dose increases, the birefringence increases, which in turn enhances the anisotropic character of the CTA films. The variation in birefringence dispersion (as the retardance or relative retardation) versus the irradiation dose is investigated. We conclude that measuring the birefringence is essential in order to provide correct refractometric data to study the structure of irradiated materials.

Journal of Optics A: Pure and Applied Optics - 2007, January