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A SPECTRAL INVESTIGATION OF LINEAR BIREFRINGENCE VIA STOKES SPECTROPOLARIMETRY: FROM STICKY TAPES TOWARDS THIN FILMS

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Resumo

Linear birefringence is a fundamental property of materials that exhibits anisotropic behavior, leading to the differential propagation of light waves along different directions. Sticky tapes, commonly found in everyday use, often possess birefringent properties due to their manufacturing processes. Understanding the spectral characteristics of the linear birefringence in sticky tapes is highly desirable to introduce polarization concepts for new students in this field. Besides, this data analysis is essential background for various applications, including optical devices and material science and engineering. In this study, we present a comprehensive investigation of the linear birefringence in sticky tapes using Transmission Stokes spectropolarimetry, and recent applications in nanostructured thin films of organic molecules. Our experimental setup comprises a broadband light (400-800 nm) source and a spectropolarimeter capable of measuring the complete Stokes vector of light. The sticky tape samples, carefully aligned in a rotating mount, are subjected to a vertically polarized light, and the transmitted light is analyzed using a rotating-retarder type of spectropolarimeter. By systematically varying the angular position of the sample from -90° to +90° in steps of 30° from the vertical reference, with fixed polarization state of the incident light, we obtained a complete set of Stokes vectors for each transmitted wavelength as a function of the angular position of the sample. By studying these parameters as a function of wavelength, we gained insights into the underlying mechanisms contributing to the birefringent behavior in the tapes, and other possible anisotropic media in materials science, such as thin films. In this context, we also conducted a comparative analysis of different types of deposition methods of a perylene derivative (bis-phenethylimide (PhPTCD)). The results show the Physical Vapor Deposition (PVD) produce isotropic samples, due to the randomness of molecular orientation related to this method, whereas the Langmuir-Shaeffer deposition (LS) promotes a certain degree of orientation, observed through a small birefringence signal. The results highlight the significant impact of these factors on the spectral behavior of linear birefringence, thereby providing valuable insights for the optimization of film manufacturing processes and the design of birefringence-based optical devices.

Palavras chave: Spectropolarimetry, Anisotropy, Thin Films