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Advancements in Optical Applications: Laser-Induced Modifications of Refractive Index and Transmittance in Polymers and Volume Phase Masks Using He-Cd 325 nm Exposure

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Introduction Vortex beams, characterized by their unique spiral phase structure and orbital angular momentum, play a crucial role in advancing various applications in photonics. This research aims to explore the creation and utilization of volume phase masks in PTR glass to control vortex beams. The innovative approach involves applying irradiated polymer films to PTR glass samples and conducting delta n measurements using a Mach-Zehnder interferometer. This method has the potential to develop new materials with tailored optical properties.

Main Part The primary objective of this study is to understand how polymer properties change when exposed to a He-Cd 325 nm laser, particularly focusing on the refractive index of PTR glass. The tasks include measuring transmittance spectra, examining transparency changes, and generating curves that illustrate how the refractive index changes with laser exposure.

The results show that the density of different sections of a vortex beam mask changes with varying laser doses across different wavelengths. The black section is the most sensitive to dose changes, followed by the grey and then the transparent section. This sensitivity could be due to differences in material properties or the beam's interaction with each section. The density of the vortex beam also changes with increasing doses for three different sections at 325 nm, indicating a clear dose effect on vortex beam density.

Furthermore, the research has quantified changes in the refractive index of PTR glass when polymer films are applied and subjected to heat treatment. This part of the research is still in progress, but the findings suggest significant potential for developing new materials with tailored optical properties.

Conclusion This study provides valuable insights into the interaction of vortex beams with materials and the modification of polymer properties using a He-Cd 325 nm laser. The findings have significant implications for advancing optical applications and developing new materials with tailored optical properties. Future work will focus on further optimizing the interaction of vortex beams with materials and exploring additional applications of the modified PTR glass

References:

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