Fabrication of Anisotropic Resin Polarizers with Liquid Crystal via VPP for Enhanced Optical Steganography

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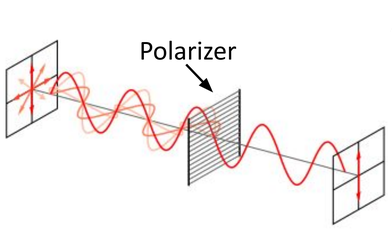
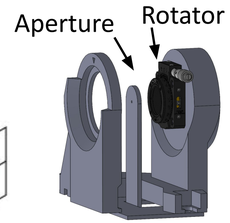
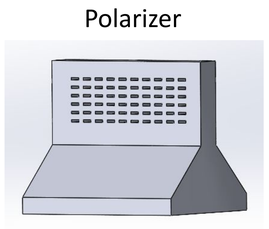
1. Background

This research focuses on investigating the potential of Vat photopolymerization in the creation of resin based polarizers with significantly improved anisotropic properties. The primary research question centers around understanding how this specific photopolymerization technique can be effectively utilized to enhance the performance of polarizing materials, particularly in the context of optical steganography. This exploration not only contributes to the advancement of photopolymerization techniques but also expands our understanding of how these techniques can be tailored to specific applications within the field of optics. This research also aims to explore the practical implications of utilizing these advanced polarizers in optical steganography, a technique used for concealing information within images or other media. By encoding and decoding hidden optical information using the enhanced polarizers, the research seeks to demonstrate their efficacy in secure data transmission and communication.

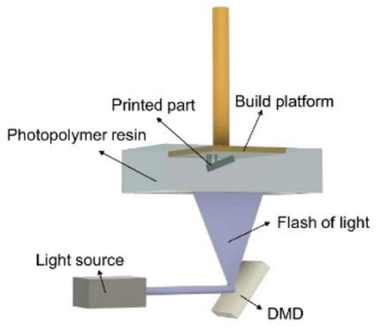




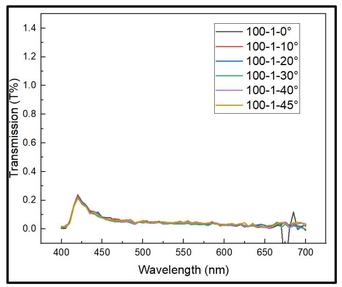


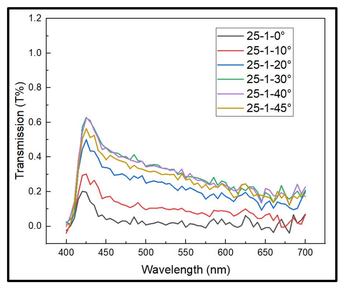
2. Methods and Materials

The polarizers are initially designed through computer-aided design. These designs are then fabricated using a process called VPP, which involves selectively curing liquid photopolymer resin layer by layer using UV light. A laser-based system projects patterns onto the resin surface, initiating polymerization and solidifying the desired structures. After fabrication, the polarizers are evaluated for their polarizing capacity using polarization microscopy.

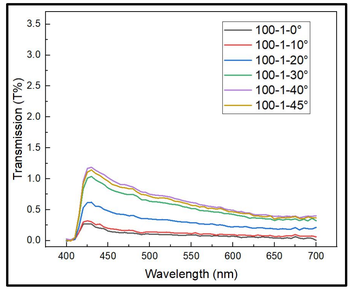


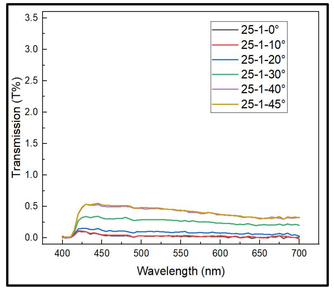
3. Results



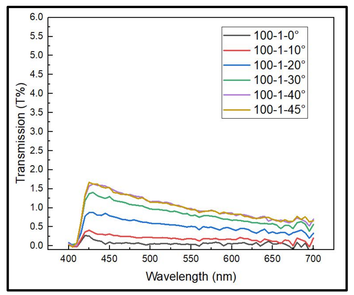


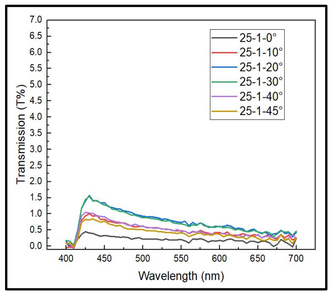
Pure Resin





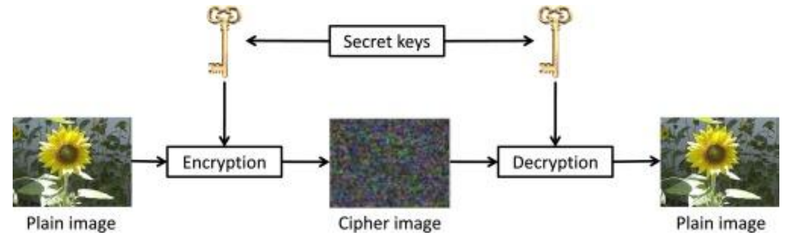
5wt% LC





10wt% LC

4. Applications



- Provides secure and sophisticated data concealment, impacting cybersecurity, defense, and finance.
- Revolutionizes data transmission in optical networks, enhancing efficiency, bandwidth, and reliability.
- Enhances diagnostic processes in healthcare, to embed additional information in medical images for resource-constrained settings.

Challenge :
Need for precise control amid resolution limitations and scalability concerns.

5. Future Work

- Encode and decode information in the structures.
- Develop more intricate and sophisticated patterns.

6. Acknowledgements

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7. References

[1] Blachowicz, T., Ehrmann, G. & Ehrmann, A. (2021). Optical elements from 3D printed polymers. e-Polymers, 21(1), 549-565. https://doi-org.ezproxy1.lib.asu.edu/10.1515/epoly-2021-0061

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