Laser Engineered Polymerisable Liquid Crystal Devices for Imaging and Adaptive Optics

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Two-photon polymerization direct laser writing (TPP-DLW) has emerged as a powerful technique for fabricating a wide range of switchable and tunable optical elements within polymerizable liquid crystal (LC) devices, enabling functionalities that are difficult to achieve using conventional fabrication methods based on substrate structuring or surface functionalization. By combining TPP-DLW with applied electric fields, it is possible to generate a rich variety of spatially varying LC director profiles, which in turn produce tunable spatial phase distributions. This approach enables the integration of advanced optical components, including computer-generated holograms, optical vortex beam generators, Fresnel zone plates, and aberration correctors, directly within LC devices. In this presentation, I will describe the fabrication process used to inscribe such optical elements and demonstrate their performance across a range of applications, including imaging and microscopy. The presentation will conclude with an outlook on the advantages and current limitations of the technique, as well as opportunities for future development and application.

Biography:

Stephen M. Morris is a Professor of Engineering Science at the University of Oxford and a Tutorial Fellow of Jesus College, Oxford. After completing his PhD at the University of Cambridge in 2006, he held a Royal Society University Research Fellowship before joining Oxford in 2013. He has received several distinctions for his research, including the British Liquid Crystal Society's Young Scientist Award and Hilsum Medal, and the Society for Information Display's Ben Sturgeon Prize. He currently serves as Associate Head of the Department of Engineering Science at Oxford and as Chair of the British Liquid Crystal Society.