Optically driven photothermal wavefront corrector

Yevhenii Shaidiuk*†[1], Kateřina Jiříková‡[1], Hadrien M.l. Robert§[1,2], and Marek Piliarik¶[1]

[1]Institute of Photonics and Electronics of the Czech Academy of Sciences – Czech Republic
[2]Institut de la Vision – Sorbonne Universite – France

Abstract

We present photothermal Spatial light modulators (PT-SLMs) allowing for polarization-independent active wavefront modulation of the transmitted beam with a broad wavelength range. The operation principle is based on the thermo-optics effect of plasmonic gold nanoparticles embedded in a polymeric matrix. A spatially patterned control beam is used to modulate the refractive index of the active PT-SLM layer. In our previous work, digital mirror devices (DMDs) were used to precisely address the PT-SLM profile allowing for rapid and efficient control of the optical wavefront.(1) However, the confined field of view and high demand for the power of the control beam limits the number of applications to specialized optical laboratories.
Here, we enhance the concept of controlling the PT-SLMs using a set of acousto-optic deflectors (AOD) for high-speed applications and better energy efficiency. A response time as short as 2 μs and 16-bit grey scale amplitude modulations and position modulation of dAOD allow for dosing the distribution of the refractive index with great precision and a large field of view. The tunable feature size with almost continuous position resolution and no polarization sensitivity in the broad wavelength range opens new opportunities for the most demanding imaging applications.

(1) Robert, H. M. L., Čičala, M., Piliarik, M., Shaping of Optical Wavefronts Using Light-Patterned Photothermal Metamaterial. Adv. Optical Mater. 2022, 2200960.

Keywords: Spatial light modulators, acousto optic deflectors, polarization independent wavefront modulation, broad wavelength range modulation

*Speaker
†Corresponding author: shaidiuk@ufe.cz
‡Corresponding author: jirikova@ufe.cz
§Corresponding author: hadrien.robert@inserm.fr
¶Corresponding author: piliarik@ufe.cz