TUNEABLE AND FREE-FORM PLANAR OPTICS

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We propose a new paradigm-shift to accurately engineer optical wavefronts by exploiting electrically-induced thermal phase-shifts at the microscale [1]. Upon circulation of current, a resistor delivers to a polymer a temperature landscape that translates into a distribution of refractive index (see Fig 1.a). By engineering the resistor design with a genetic algorithm, we demonstrate an accurate control over the wavefront of the transmitted light [2]. We demonstrate quasi-achromatic, polarisation-insensitive electrical components which can apply a predetermined, continuous local wavefront shaping with unprecedented degrees of freedom. We show that this device, coined as *SmartLens*, can efficiently generate elementary Zernike polynomial functions and therefore dynamically create several optical functions (see Fig1.b and c.). When arranged in an array, it can control, correct or refocus various regions of polychromatic wavefronts or images, as illustrated in a simple but powerful example based on a tuneable and broadband microlens array. The achieved level of control combined with a low production cost and integration compatibility makes *SmartLens* a promising building block for advanced microscopy and endoscopy.

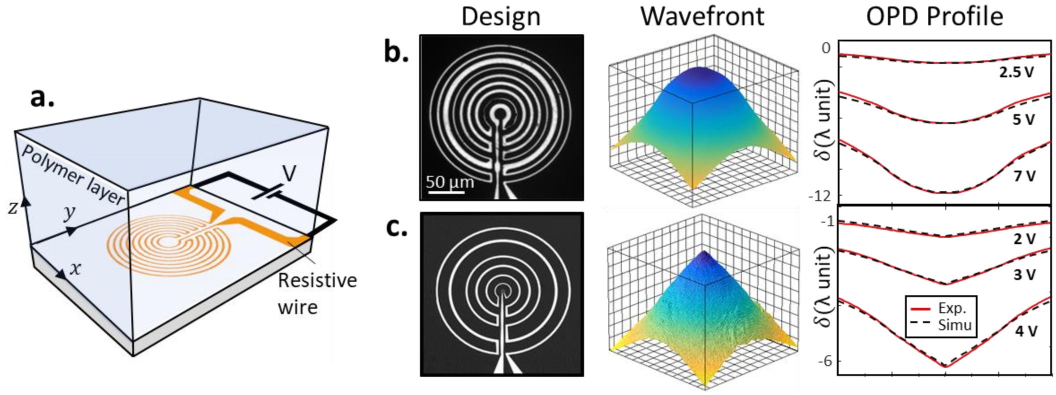

Figure 1 – (a) Schematic of the electrically tuneable micro-optic device. Electrically-controlled resistive spirals induce thermal refractive index variation in a thermo-responsive material. (b,c) Wavefront engineering: experimental results for 2 spiral geometries optimized to generate (b) a defocus aberration Z_2^0 (diverging lens) and (c) a conical surface. In each case, an optical reflection image of the fabricated spiral design and the corresponding generated wavefront are shown as well as the phase profiles for different applied voltages.

Reference

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