Design of metaholographic sensor using liquid crystallinity

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Metasurface has been extensively researched for promising hologram due to their potential for high resolution, miniaturization, and multi-function. However, previous metaholograms require passive manipulation on the properties of light (e.g., incident angle, polarization) to change holographic information. Recent works have proposed active metaholograms using stimuli-responsive materials for meta-atoms but several issues remain in low freedom of structure, limited stimuli, and slow response. In this work, we propose the active platform of metaholographic sensor to use in a variety of fields by combination of a stimuli-responsive liquid crystals (LCs) and metasurface (MS). The metasurface composed of nanostructures with sub-wavelength scale is programmed to display two holographic images upon left-(LCP) and right-handed circular polarization(RCP). The polarization is modulated by the LC layer that is designed to change the retardation of LCs by various stimuli (electric field, heat, pressure and toxic gas). As a result, we demonstrated that the LC-MS systems are selectively responsive to stimuli and immediately realize the holographic images with their simple and flexible system.