

Light induced exotic chiral surface reliefs in azo-polymers

Takashige Omatsu^{1,2}

¹Graduate School of Engineering, Chiba University, Chiba, China

²Molecular Chirality Research Center, Chiba University, Chiba, Japan

*corresponding author, E-mail: omatsu@faculty.chiba-u.jp

Abstract

We review the formation of exotic chiral surface reliefs of azo-polymers by irradiation of structured light beams with optical angular momentum, that is orbital and spin angular momentum. Such chiral surface relief will be applied to be advanced chiral metasurfaces.

Structured light beams, including Laguerre-Gaussian (LG), Helical Ince-Gaussian (HIC), and Bessel beam (BB) modes, possess an annular intensity spatial form and an orbital angular momentum (OAM), associated from a helical wavefront with an on-axis phase singularity, as well as non-diffraction property, and self-healing wavefront. Thus, they have been widely studied in a myriad of fields, including optical manipulation, super-resolution microscope, and quantum/optical communications [1,2]. Furthermore, the structured light field allows the orbital motion of the irradiated materials to form nano/micro-scale helical structures [3-6].

Azo-polymers exhibit photo-induced mass transport, originating from an optical gradient force, anisotropic photo-fluidity, and trans-cis photo-isomerization, thereby enabling the formation of photo-induced reversible reliefs which reflect the spatial intensity profile and polarization of the irradiated light [7,8]. Thus, they provide a myriad of applications, for instance, the development of rewritable photonic circuits, including photonic/plasmonic crystals, metasurfaces, and optical data storages.

To date, it is found that structured light beams with OAM twist azopolymers to form chiral surface reliefs, reflecting helical wavefronts of the irradiated structured light fields, with the help of spin angular momentum (SAM) associated with circular polarization [9-11]. Furthermore, it is discovered that the structured light beams even without OAM and only with SAM enable the formation of chiral relief [12].

In this work, we review the formation of exotic chiral surface reliefs of azopolymers by employing versatile structured light beams. Also, we address two-photon induced chiral surface reliefs by ultrafast structured light beams.

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