

Photomobile polymer materials with programmable structures

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Crosslinked liquid-crystalline polymers (CLCPs) are a class of materials that show macroscopic deformation in response to actinic light [1]. In these materials, the alignment of LC molecules (mesogens) is strongly coupled with a conformation of a single polymer chain as well as a macroscopic shape of the material. Upon exposure to light to disorganize the alignment of mesogens, deformation of the material occurs. CLCPs as photomobile polymer materials have been intensively studied due to their large photomechanical effects, which have enabled the fabrication of unique devices such as motors [2], inch worm [3] and robotic arms [3]. Although a variety of 3-dimensional movements of materials based on CLCPs have been demonstrated, there still remain several issues to be challenged: 1) mechanical properties of these materials should be improved; 2) fabrication processes of these materials should be improved; 3) responsive properties should be improved.

In this work, aiming at improving the mechanical properties of CLCPs, we examined the photoresponsive behavior of interpenetrating polymer networks (IPNs) composed of CLCPs incorporating azobenzenes and crosslinked polymethacrylates that show excellent mechanical and optical properties [4]. Furthermore, we developed remoldable CLCPs with exchangeable crosslinks based on dynamic covalent bonds, which will significantly improve the fabrication processes of CLCPs [5].

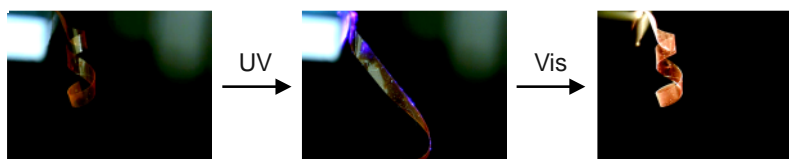


Fig. 1. Photomobile liquid-crystalline elastomers with rearrangeable networks.

References

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Speaker Biography

Tomiki Ikeda received his BSc (1973), MSc (1975) and PhD (1978) in Polymer Chemistry from Kyoto University. He then pursued postdoctoral research in biologically active polymers at University of Liverpool, UK. He joined Tokyo Institute of Technology in 1981 working in the field of polymer chemistry, photochemistry and materials chemistry. In 1994, he was promoted to full professor of polymer chemistry, and in 2009 he was appointed Director of the Chemical Resources Laboratory. He moved to Chuo University in 2011, and he serves as a professor at Technical Institute of Physics and Chemistry, Chinese Academy of Sciences from 2016. He received 'The Chemical Society of Japan Award' in 2009, 'The Award of the Society of Polymer Science, Japan' in 2003, and 'The Award of the Japanese Liquid Crystal Society' in 1999. He served as Vice-President of Japanese Liquid Crystal Society in 2003, 2009, and 2010. Also as Vice-President of the Chemical Society of Japan in 2005 and 2006. He acted as Associate Editor of Journal of Materials Chemistry (RSC, UK) during 2006-2010.