Patterned Polymer Networks Formed in Nematic Liquid Crystals

Vijay Kumar Baliyan, Sudarshan Kundu, Vineet Kumar, Seung Hee Lee and Shin-Woong Kang*
Department of BIN Convergence Technology, Chonbuk National University, Jeonju, Korea 561-756
Tel.:82-63-270-2847, E-mail: swkang@jbnu.ac.kr

We have investigated patterned polymer networks formed by using photo polymerization of mesogenic monomer in nematic liquid crystal as a template. The polymer networks have been both orientationally and spatially templated by manipulating positional as well as orientational order of the nematic LC host, achieved by using patterned electrodes with a homeotropic alignment layers. Spatial order of the polymer networks are precisely determined by the patterned electrode while orientational order is transferred from the local director of LC host. Consequently, the templated polymer networks reveal not only a morphological pattern but also a pattern of optical birefringence indicating orientational order of the network in molecular level.

Polymerization of reactive mesogen has been performed in the nematic host, as a reaction medium, which is loaded into the vertically aligned in-plane switching cells. Under various amplitude of applied electric field, one-dimensionally periodic pattern of director profile has been obtained and reactive mesogens have been photo-polymerized. Due to elastic distortion of LC host, morphologically distinct polymer structures have been observed after removal of LC host.

To understand the origin of the templating effect, computer simulations for a director configuration, distribution of electric potential and elastic deformation density across the cell have been performed. We will discuss important factors affecting the templating phenomenon based on the careful examination on our experimental and simulation results.

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