

A study of surface influence on crystal growth of polymer-stabilized blue phase liquid crystals

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We demonstrate the manipulation of crystal growth of polymer-stabilized blue phase liquid crystal (or PSBP-LC) by various surface treatments of the substrates. Without alignment layer on the substrate, both heterogenous and homogenous nucleation happen during the cooling process, as shown in Fig. 1(a)-(d). The result shows random crystal orientation of PSBP-LC. However, with alignment layer, such as cell with anti-parallel alignment(AP) or vertical alignment(VA), the heterogenous nucleation dominates during the cooling process, as shown in Fig. 1(e)-(h) and Fig. 1(i)-(l) shows. As a result, we can achieve PSBP-LC with high uniformity of crystal orientation in VA cell and strong blue bragg reflection in AP cell. The study provides a different way to control the growth of PSBP-LC. We believe this study can help the understanding of crystal growth of PSBP-LC and the development of PSBP-LC based optical-electro device.

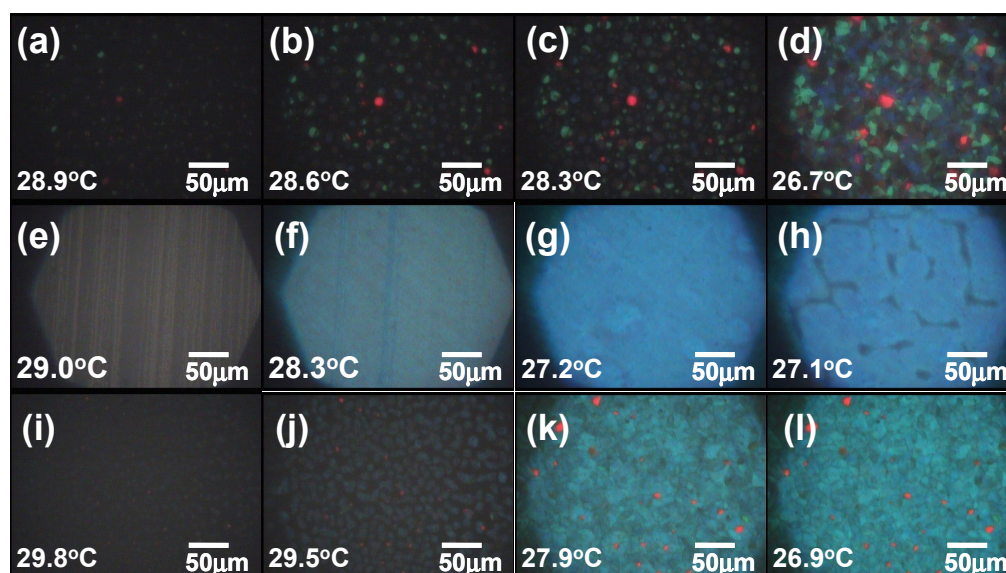


Fig1. Morphologies of PSBP-LCs sample under a reflective polarizing microscope (a), (b), (c), and (d) are crystal growth process in ITO cell at 28.9 °C, 28.6 °C, 28.3 °C, and 26.7 °C, respectively. (e), (f), (g), and (h) are crystal growth process in AP cell at 29.0 °C, 28.3 °C, 27.2 °C, and 27.1 °C, respectively. (i), (j), (k), (l) are crystal growth process in VA cell at 29.8 °C, 29.5 °C, 27.9 °C, and 26.9 °C, respectively. The cooling rate was 0.5 °C/min, starting from the isotropic state.

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References

1. H. Kikuchi, M. Yokota, Y. Hisakado, H. Yang, and T. Kajiyama, "Polymer-stabilized liquid crystal blue phases," *Nat. Mater.* 1, 64-68 (2002)
2. H. S. Chen, Y. H. Lin, C. H. Wu, M. Chen, and H. K. Hsu, "Hysteresis-free polymer-stabilized blue phase liquid crystals using thermal recycles," *Opt. Mater. Express* 2, 1149-1155 (2012).
3. M. Chen, Y. H. Lin, H. S. Chen, and H. Y. Chen, "Electrically assisting crystal growth of blue phase liquid crystals," *Opt. Mater. Express* 4, 953-959 (2014).