

Effect of Anchoring Energy on Alignment of Uniformly Lying Helix Configuration under Intermediated Pretilt Angle

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In cholesteric liquid crystals (ChLCs) with a short pitch below visible light, the uniformly lying helix (ULH) mode, exhibiting a fast response based on the flexoelectric effect, has been observed¹⁻³. Although the ULH mode has attracted much attention in fast display applications, it is very difficult to obtain stable ULH texture in whole area under planar alignment configuration since a Grandjean (standing helix) configuration is energetically more stable. To obtain the stable ULH texture, planar and vertical alignments were alternatively patterned coincided with a pitch of the ChLC⁴. However, the submicron pattern is not applicable to large area for displays and is not guaranteed to proper alignment reflecting the ChLC pitch.

In this work, we investigated the anchoring energy effect on the ULH formation in intermediated pretilt angles. To produce the intermediated pretilt angle, a vertical alignment was coated onto the rubbed planar alignment layer and the thickness of the vertical alignment layer governed the pretilt angle⁵. Also, enhancement of the anchoring energy at a given pretilt angle was achieved by coating the vertical alignment material mixed with reactive mesogen (RM)⁶. The ULH formation in the wider area was obtained in the weaker anchoring energy. Note that the anchoring energy is decreased with increasing the pretilt angle. In addition, the similar ULH textures were observed at the similar anchoring energies even at different pretilt angles. As a result, the formation of the ULH texture is relevantly affected by the anchoring strength rather than the pretilt angle. However, the better dark state was achieved at a high pretilt angle since a single optic axis of the ULH configuration was formed at the high pretilt angle as shown in Fig. 1.

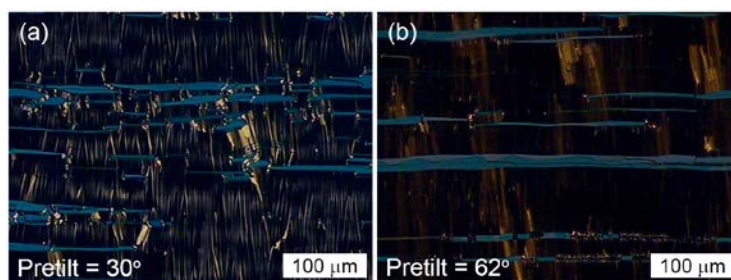


Fig. 1. The polarizing microscopic textures of (a) the low pretilt angle (30°) and (b) the high pretilt angle (62°) samples at the same anchoring strength (12 $\mu\text{J}/\text{m}^2$). Note that bluish area and the black area represent the Grandjean (standing helix) configuration and the ULH configuration, respectively.

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