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UV-curable liquid crystal is mesogenic monomer which can be aligned by usual method such as a rubbing technique. By UV-irradiation, it polymerizes to give a polymer in which the alignment of the liquid crystal is fixed. Applications and materials for the retarder are reviewed.

Keywords Mesogenic monomer; retardation film

Introduction

UV-curable liquid crystal is mesogenic monomer which can be aligned by usual method such as a rubbing technique. By UV-irradiation, it polymerizes to give a polymer in which the alignment of the liquid crystal is fixed. The liquid crystal is applicable to fabricate various types of retarder for Liquid Crystal Displays (LCDs). We have developed the liquid crystal optimized for this purpose. Applications and properties of the liquid crystal are reviewed.

Fabrication of Retarder

Figure 1 presents processes to make the retarder. First, the liquid crystal is coated on a glass substrate with an alignment layer. Next, the liquid crystal is irradiated with UV light at room temperature to polymerize.

Materials

In Table 1, clearing point, birefringence and viscosity of the liquid crystals are summarized. Various types of alignment can be obtained by coating on a substrate with an alignment layer.

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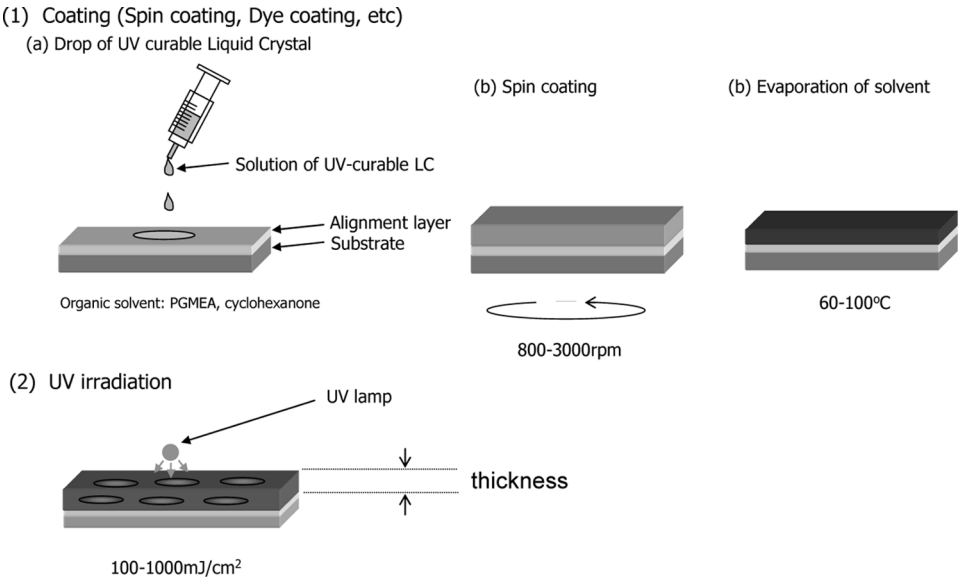

Figure 1. Fabrication process of retarder.

Applications

The retarder with homogeneous alignment is applicable to compensate color [1] or widen viewing angle of polarizer [2]. That with homeotropic alignment is also applicable to widen viewing angle of polarizer [2]. That with hybrid alignment is effective to improve viewing characteristics of TN displays [3,4].

Patterned Retarder

An in-cell patterned retarder makes it possible to improve brightness and contrast ratio of transflective LCDs [5]. The retarder can be obtained by photo polymerization of an UV-curable liquid crystal through a mask. It is important that the resolution of the pattern is higher than that of a pixel of the LCD because the pixel must be divided into transmissive and reflective area. High thermal stability of the retardar is also important because the retarder is heated over 200°C during LCD

Table 1. Properties of UV-curable liquid crystals

Alignment	UCL-017 homogeneous	UCL-008 hybrid	UCL-018 homeotropic	UCL-Ch001 cholesteric
(Before polymerization)				
T_{NI} (clearing point) [°C]	70	70	65	65
η (viscosity at 20°C) [mPa · s]	ca. 3000	ca. 3000	ca. 1300	–
(After polymerization) Δn (birefringence)	0.17	0.17	0.17	–

Δn was measured at $\lambda = 589$ nm.

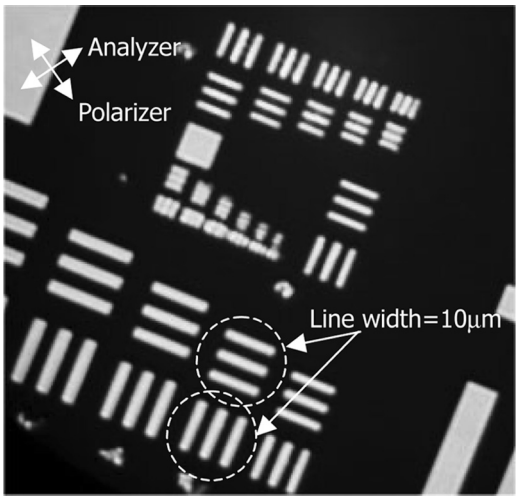

Figure 2. Polarizing photomicrograph of retarder.

fabrication processes such as sputtering to form ITO electrode on the retarder and baking to make polyimide alignment layer on the electrode. We have attained resolution $<15\,\mu m$ and thermal stability of retardation after 60 minutes heating at $240^{\circ}C > 90\%$ by optimizing fabrication processes and materials. Figure 2 shows an example of polarizing photomicrograph of patterned retarder with various width of pattern (Line/Space = 1/1). It is clear that resolution under $15\,\mu m$ has been achieved.

Conclusion

Applications and properties of a UV-curable liquid crystal are reviewed. The liquid crystal is applicable to make retarder in which various types of alignment are fixed and has an advantage in lithograph capability to obtain a patterned retarder.

References

[1] Hanami, T., Hara, M., Odai, H., & Iwasa, K. (1988). Proc. of 14th Liquid crystal conference in Japan, 64.
[2] Chen, J., Kim, K.-H., Jyu, J.-J., Souk, J. H., Kelly, J. R., & Bos, P. J. (1998). *Digest of SID*, 315.
[3] van de Witte, P., Stallinga, S., & van Haaren, J. A. M. M. (1997). *Digest of SID*, 687.
[4] Toyooka, T., Yoda, E., Kobori, Y., Yamanashi, T., & Itoh, H. (1998). *Digest of SID*, 698.
[5] Doornkamp, C., van der Zande, B. M. I., Roosendaal, S. J., Sofmeel, L. W. G., van Glabbeek, J. J., Osenga, J. T. M., & Steenbakkers, J. A. M. (2003). *Digest of IDW '03*, 685.