Reorientation Evaluation of Photoinduced Liquid Crystalline Polymer Pattern Fabricated by Hybrid Nanoimprinting with Linearly Polarized Ultra Violet Irradiation

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The photoinduced orientation of polymeric films has received much attention owing to its potential use in many types of optical and photonics applications. Uchida and Kawatsuki found that P6CAM, which is photoinduced liquid crystalline polymer, exhibits a large photoinduced molecular reorientation[1]. In addition, we reported that P6CAM molecules were also aligned by thermal nanoimprinting using line and space (L&S) patterned-mold [2]. Therefore, there is a possibility that the bidirectional molecular orientation is induced on the identical L&S-P6CAM pattern by hybrid process of thermal nanoimprinting with linearly polarized ultra violet (LPUV) irradiation. We performed the hybrid nanoimprinting onto P6CAM film and evaluated the orientation direction of imprinted P6CAM pattern.

The P6CAM molecules are reoriented perpendicular to the LPUV direction [1]. On the other hand, in thermal nanoimprinting, the molecules are reoriented parallel to the line direction. In addition, the random orientation of P6CAM molecules remains in imprinted flat area [2]. We therefore expect that two types of P6CAM molecules reorientation on the identical pattern are occurred by using the quartz mold partially-coated with thin Au film to shield against LPUV. One is the molecular orientation induced by thermal nanoimprinting, the other is that induced by thermal nanoimprinting and LPUV irradiation. Figure 1 shows the illustration of the hybrid process. (1) The P6CAM film was heated to 110 °C to carry out thermal nanoimprinting. (2) The mold with 2 μm L&S pattern was pressed to the P6CAM film. (3) The P6CAM film was exposed to LPUV through the quartz mold. (4) The P6CAM film was heated to 165 °C to induce the molecular reorientation due to LPUV irradiation. (5), (6) After cooling, the mold was separated from the P6CAM film. Figure 2 shows the illustration of the relationship between the directions of LPUV and line pattern. We observed the imprinted P6CAM pattern by polarization optical micrography (POM) under crossed-nicols, as shown in Fig. 3. The area and brightness of the bright field were changed by changing the angle of crossed-nicols. This result indicates that the P6CAM molecules were reoriented in different directions on the identical imprinted pattern by hybrid nanoimprinting using the quartz mold partially coated with thin Au film. In the presentation, we discuss the molecular

orientation of the P6CAM pattern imprinted by hybrid process in detail.

Acknowledgements
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References
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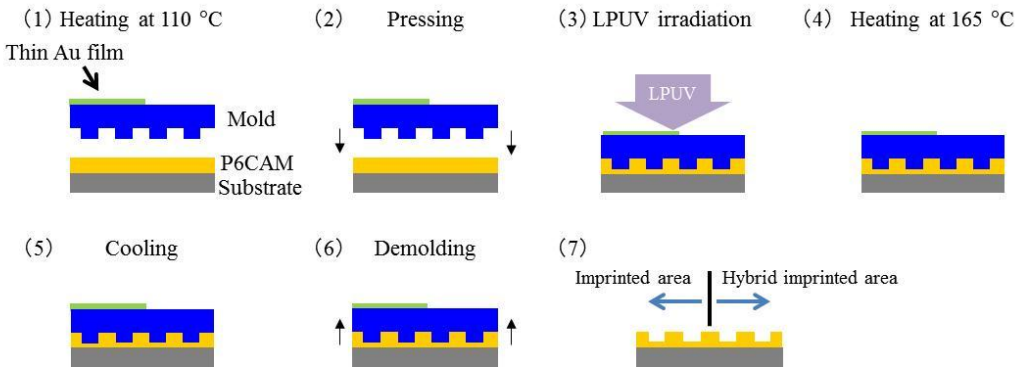


Figure 1. Illustration of hybrid process

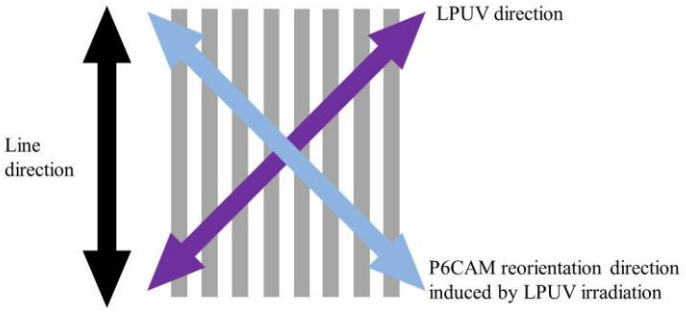
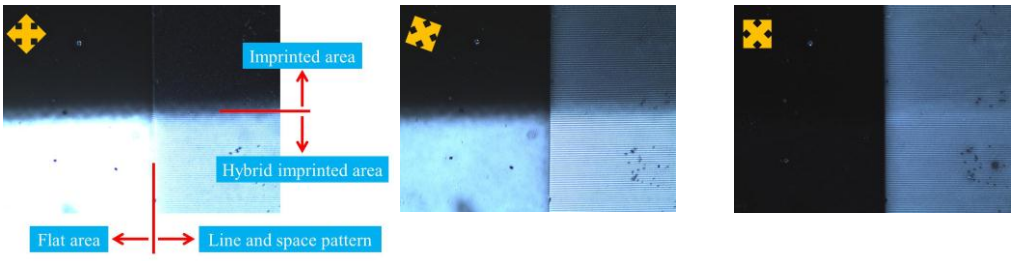


Figure 2. Relationship between directions of LPUV and line.



(a) (b) (c)

Figure 3. Polarization optical micrography (POM) under crossed-nicols at the angle of (a) 0°, (b) 25°, and (c) 45° images of P6CAM pattern fabricated by hybrid process.