Effect of drying to orientation process of chromonic liquid crystal

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The effect of drying speed on an optical anisotropic film of chromonic liquid crystal by use of applicator was investigated. Some chromonic dyes form a rod like aggregation in an aqueous solution and change to a chromonic liquid crystal in a certain concentration and temperature of the solution. When the chromonic liquid crystal is applied to a glass substrate by an applicator, the aggregates in the chromonic liquid crystal are oriented in one direction in the thin film, and it exhibits an optical anisotropy such as birefringence and dicrhoism. The application process would be able to separate to four processes as shown in Fig.1. First, the sample is contacted to the glass substrate, then, it is sheared by the applicator. After getting out of a small gap of shear area, the sample surface is elongated and applied the substrate in a thin film. After that, the thin film of the sample is dried up and the aggregates orientation is fixed. In our previous study, we found that once the aggregates are orientated to one direction at elongation region but aggregates orientation is relaxed quickly. Even though the wet film after elongation region has weak extinction, the dry film we found finally has high extinction.

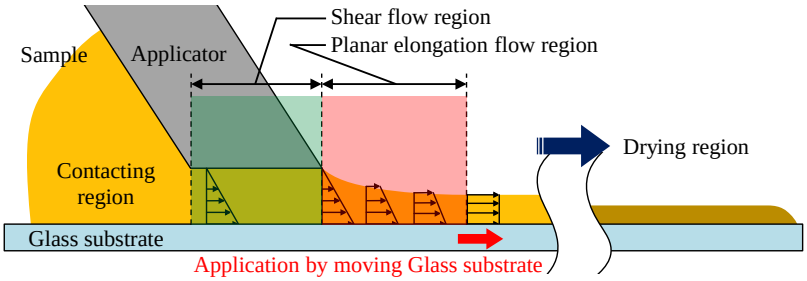

Fig.1 Pattern diagram of application process.

The drying process was considered to be important to make the optical anisotropy film having a uniform and high dichroism. Sample of the chromonic liquid crystal, Biebrich Scarlet Sodium Salt of 6wt% aqueous solution (BSS6wt%), was applied by applicator with 2 μm gap. We measured the extinction during drying process by polarimetry technique and a digital camera. The extinction during drying process can be separated three regions as shown in Fig.2. Region I (wet film): the extinction is fluctuated periodically. Region II (passage of contact line): the extinction is increased dramatically. Region III (dry film): the extinction is constant. The fluctuation of extinction at region I would be disturbed the aggregates orientation which caused by elongation flow. We discuss the effect of moving speed of contact lines to the aggregates orientation.

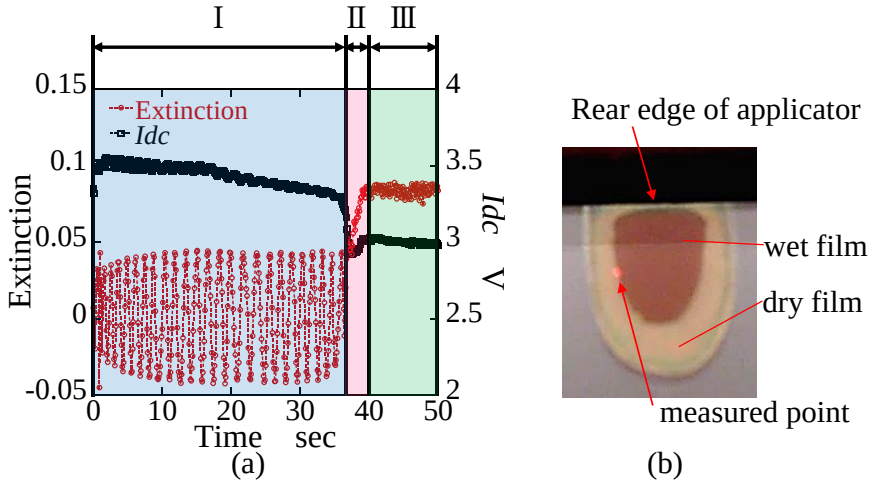

Fig.2 (a) Extinction during drying measured by laser polarimetry method. (b) Film condition in region II. The extinction was suddenly increased when contact line was passed at measurement point.