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Electrooptic Effect of Lyotropic Liquid Crystal

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It is known that cellulose forming a cell wall of a plant is lyotropic liquid crystal showing a cholesteric liquid crystal aspect by a mixture condition with water. This cellulose liquid crystal has a selective reflection characteristic, and, besides, a selective reflection wavelength varies with addition of ion impurities. In late years, Chiba [1,2] succeeded in changing the selective reflection wavelength by changing the ion density by applied electric field. It is realization of an electrooptic effect of the lyotropic liquid crystal that it was thought that electric responsibility is low, and this is a very interesting report. Here we changed a kind and the density of the ion additive and examined an electrooptic effect of cellulose liquid crystal in detail.

Hydroxypropyl Cellulose (Wako Pure Chemical Industries, Ltd.) was used as lyotropic liquid crystal. Hydroxypropyl Cellulose (HPC) water solution of 62.5 wt% including a small amount of ion additive was sandwiched with two glass substrates as shown in Fig.1. The two glasses were separated for 1mm by two sheets of graphite that are also used as electrodes. Because a remarkable change of selective reflection wavelength was observed only near anode in the electrooptic measurement, the measurement domain was limited in the vicinity of the anode.

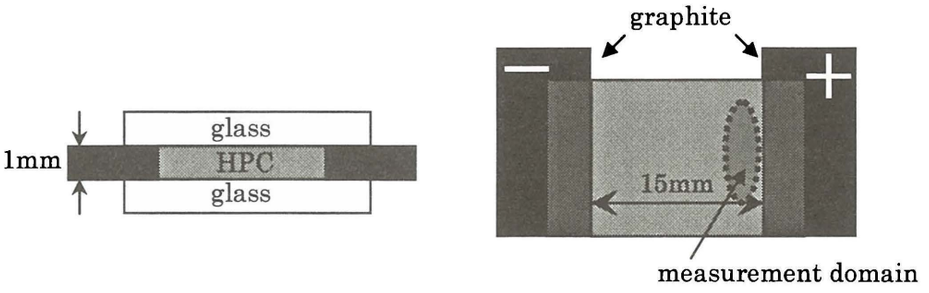

Fig.1 Schematics of the cell for liquid crystal evaluation.

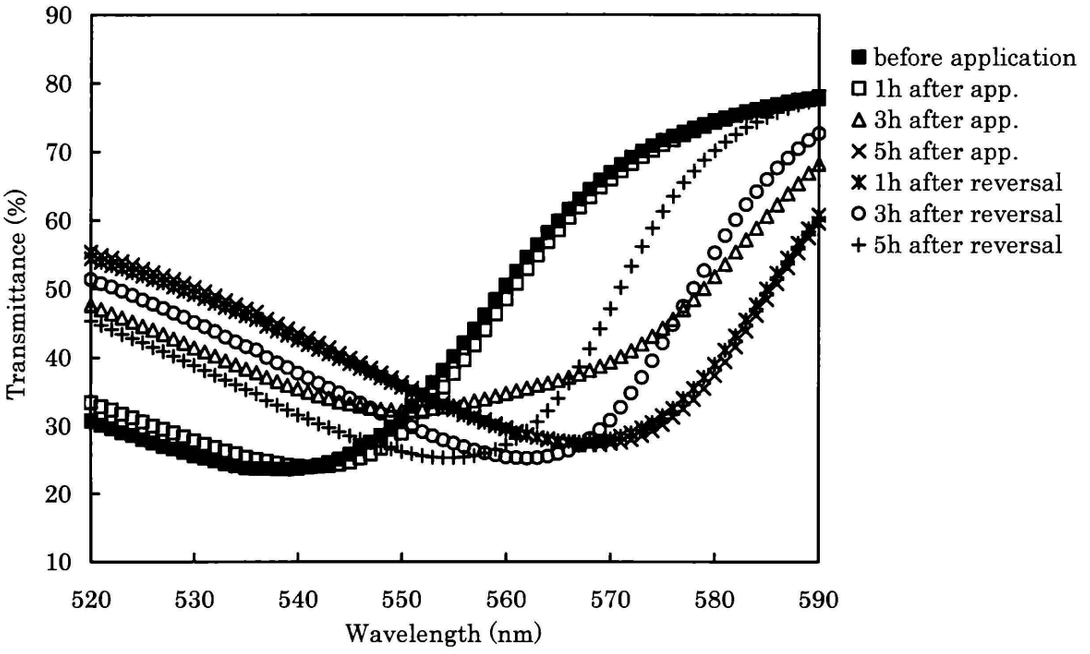

Fig.2 Change of transmittance in the electrooptic measurement.

Figure 2 shows a change of a transmittance spectrum of the solution with 0.5 M NaCl additive under dc voltage of 3.3V application. The polarity of applied voltage was reversed at 5h after start of the application. Trough wavelength corresponds to the center wavelength of the selective reflection. Figure 3 shows the change of the trough wavelength. It can be mentioned that the selective reflection can be changed by applied voltage. When the voltage is applied, the selective reflection wavelength is shifted to the long wave length side slowly. The wavelength returns to the short wavelength side when turned over polarity of the voltage next.

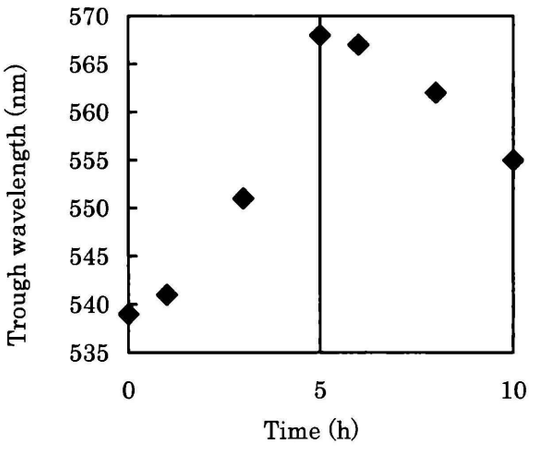

Fig.3 Change of the trough wavelength

References

[1] R. Chiba et al., Macromolecures, **36**, pp.1706-1712, 2003.

[2]Y. Nishio et al., Ekisho, **7**, pp.218-227, 2003.