Molecular orientation of nematic liquid crystal near soft-polymer alignment surface

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The molecular orientation of nematic liquid crystal (NLC) molecules on soft polymer alignment layers with a weak anchoring strength has been an attractive subject for applied and fundamental researches [1-2]. Gliding effect, which means the LC director orientation at the interface between the soft-polymer and the LC molecules, has been studied by many researchers using two kinds of polymers for top and bottom alignment layers [3-5]. They explained the gilding effects as a function of temperature and electric or magnetic field.

In this paper, we demonstrate the relaxation characteristics of NLC molecules related to surface gliding effect with photo-curable polymer (PCP) film as a soft polymer. The easy axis of the NLC on the soft polymer surface was reoriented by the in-plane electric field due to weak surface anchoring strength. After removing the electric field, the relaxation of NLC molecules near the soft polymer surface takes longer time than the NLC bulk reorientation. The PCP is very useful for changing the surface properties, such as anchoring energy and viscosity, with various UV exposure and thermal curing conditions. Our experimental results show that the relaxation characteristics of LC molecules depend dominantly on surface anchoring of the film and physical parameters of NLC. And the surface viscosity was one of crucial factors having influence on surface dynamics of NLCs. We also proposed a theoretical model to describe the physical mechanism of surface gliding effect of NLC molecules.

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References

[1] P. Vetter, Y. Ohmura, and T. Uchida, Jpn. J. Appl. Phys. **32**, 1239 (1993).
[2] V. P. Vorflusev, H.-S. Kitzerow, and V. G. Chigrinov, Appl. Phys. Lett. **70**, 3359 (1997).
[3] T. Nose, S. Masuda, and S. Sato, Jpn. J. Appl. Phys. **30**, 3450 (1991).
[4] S. Faetti, M. Nobili, and A. Schiron, Liq. Cryst. **10**, 95 (1991).
[5] S. Faetti and M. Nobili, Liq. Cryst. **25**, 487 (1998).