Spectroscopic Studies of Molecular Arrangements in Photoreactive Liquid Crystal Mixtures

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Abstract

The use of photo-reactive liquid crystals (LC) with acrylate functional groups, i.e. reactive mesogen molecules, has shown to be one of promising ways of constructing ultra-thin and high quality optical retardation films. It has been known that the orientation status of LC molecules during a curing process may affect the molecular arrangement in the cured film, and thus determinng physical and optical properties of the film [1-3]. In the present study, spectrocopic techniques were employed to investigate curing and alignment mechanisms of LC molecules on various processing conditions. The miscibility of LC molecules with non-reactive rigid molecules have been studied using FTIR and Raman spectroscopic methods. DSC experiments were conducted to investigate the thermodynamic behavior of mixed liquid crystals. Polarized FTIR and UV/Vis spectroscopy were used to study the change in the molecular orientation of photo-reactive mesogen molecules before and after photo-curing reactions.

Mixtures of a reactive mesogen with a small size liquid crystal exhibit a depression of transition temperature from LC to liquid phase. Since small LC molecules impede the formation of regular arrangement of reactive mesogen molecules, they behave like impurities which retard the formation of the LC phase. By curing the LC mixture, which shows a uniform nematic LC phase, a network structure is formed with the reactive mesogen, and the arrangement of LC molecules are maintained over the transition temperature from LC to liquid phase. The small LC molecules in the LC mixture maintain the same molecular arrangement with the reactive mesogen molecule through π-π interactions.

References

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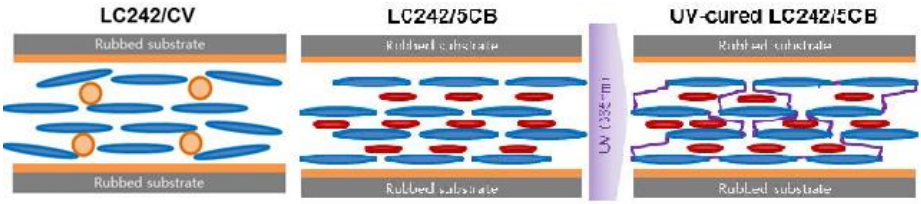

Figure 1: Various models of the molecular arrangement of nematic liquid crystal mixtures.