Acetylene containing high birefringent rod-type reactive liquid crystals based on 2-methylhydroquinone core

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High birefringent liquid crystalline materials have been attracting interest for application in optical devices such as optical compensation films for wide-viewing angle in LCD. Also, high birefringence liquid crystals have utilized in the field of display, electrooptical materials such as laser beam steering, telecommunications, infrared spatial modulators, and adaptive lenses [1]. A number of high $\Delta n$ calamitic liquid crystals have been synthesized and studied. The $\Delta n$ of liquid crystals are mainly determined by $\pi$-electron conjugation length, molecular shape, and order parameter. Thus, a more linearly conjugated LC would exhibit a larger optical anisotropy. High $\Delta n$ materials have been obtained by increasing the molecular $\pi$-electron conjugation length and introducing highly polarizable end groups, such as difluoroisothiocyanate, benzene rings, and acetylene linking groups, to give high dielectric anisotropy [2].

In this study, we have investigated new high birefringence rod-type liquid crystals which have acetylene groups on 2-methylhydroquinone core to obtain thin and efficient optical films. And, we introduced benzoate linker between the core and cross-linkable acrylate terminated alkyl side chain for controlling the liquid crystalline phase to nematic phase and solubility in common coating solvents. Acetylene-phenyl containing asymmetrical calamitic reactive liquid crystals were successfully synthesized from 2-methylhydroquinone via esterification reaction and palladium catalyzed Sonogashira coupling reaction. The molecular structures of high $\Delta n$ reactive liquid crystals were characterized by NMR spectroscopy, elemental analysis, and mass spectrometry. The liquid crystalline property of prepared compound was characterized by differential scanning calorimetry and polarized optical microscopy. Also, alignment behavior and photopolymerization property of prepared reactive liquid crystals on the rubbed polyimide alignment layer was studied. The prepared rod-type liquid crystals exhibited the nematic phase and their films have high birefringence of ~0.4.

References:

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