Monitoring Molecular Orientation Change Induced by Mechanical Stimuli in Chiral-Nematic Liquid Crystal Elastomers with Luminescent Molecules

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Liquid crystal materials are highly responsive to external stimuli, such as heat and electric fields. Chiral nematic liquid crystals are characterized by a helical structure, which results in a periodic distribution of refractive index. In aqddition, the chiral nematic liquid crystals reflect circularly polarized light at a specific wavelength with the same chirality as the helix. When these materials have luminescent properties, circularly polarized luminescence is observed. Previously, it has been reported that the wavelength of the selctive reflecrion is changed by strain owing to change in the molecular orientation. However, it has not yet been clarified how the molecular orientation is affected by the application of strain. Thus, this study aimed to investigate the changes in molecular orientation induced by mechanical stimuli in chiral nematic liquid crystal elastomers with a luminescent moleculra probve.

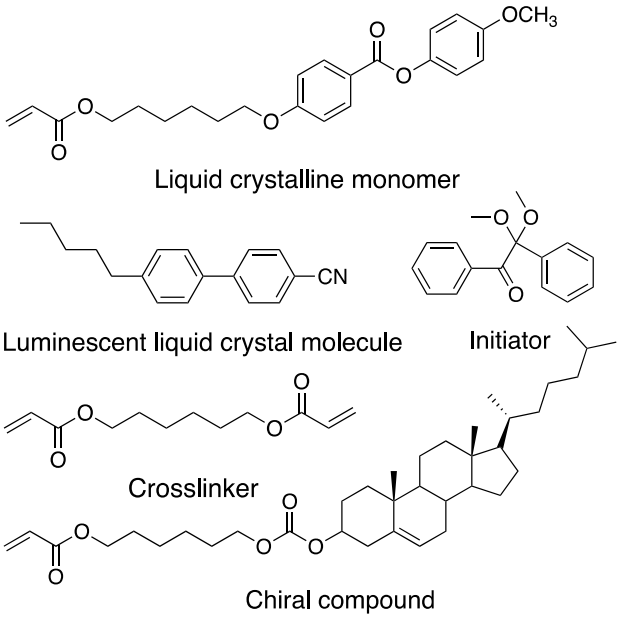

Figure 1. Chemical structures of a monomer mixture used in this study.

The chemical structures of materials used in this study are shown in Figure 1. To produce the film, we utilized photopolymerization by exposing the monomer mixture to UV light with at 365 nm in a glass cell. The resulting film and its reflectance spectra are shown in Figure 2. We observed the emission spectrum of the film using a circularly polarized light filter, as shown in Figure 3. We found that at 0% tensile strain, the reflection band and emission peak of the film coincided at 410 nm. We also confirmed that the film showed left-handed circular polarized emission with a *g* value of approximately 10^{-1} at 410 nm.

1) K. Hisano, O. Tsutsumi, *et al.*, *Adv. Funct. Mater,* **2021**, 2104702.

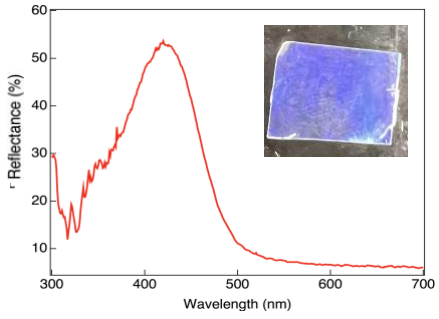

Figure 2. The image of the film and its reflectance spectra

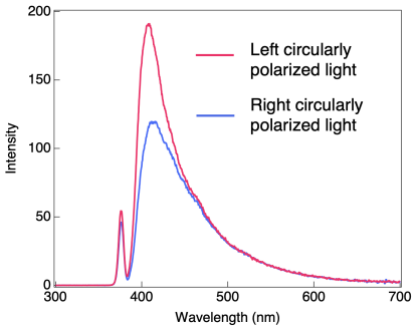

Figure 3. The luminescent spectra of the film