Imprinting of cholesteric liquid crystal constructions via UV-induced polymerization

Yan-Song Zhang, Sri Fitriyani and Jui Hsiang Liu*
Department of Chemical Engineering, National Cheng Kung University, 70101 Taiwan
*E-mail: jhliu@mail.ncku.edu.tw

The most distinct optical properties of the cholesteric liquid crystals are the strong selective Bragg reflection and its circular dichroism behavior. Within the bandwidth, right circularly polarized light is reflected by a right handed helix, whereas left circularly polarized light is transmitted. Outside the range of bandwidth both polarized light are transmitted. Because Δn is typically limited to 0.1–0.3 for colorless organic compounds, CLCs typically exhibit a $\Delta\lambda$ of less than 80 nm in the visible spectrum. Despite the fact that a narrow reflection band is desirable for applications such as optical filters, polarizer, laser and thermal imaging, it becomes a limitation in other applications, such as reflective displays, broadband circular polarizers, and switchable mirrors.

Fabrication of broadband cholesteric liquid crystal imprinted cell by controlling photopolymerization has been performed. The broad band Bragg reflection cholesteric liquid crystal cells have been achieved by using UV bleachable dye, temperature variance photopolymerization process, etc. In this study, imprinting and broadening of reflection band of cholesteric liquid crystal cells were achieved via controlling UV polymerization. Intensity gradient of UV light was achieved by adjusting the distance between UV lamp and the sample cell. Intensity of UV light may affect the polymerization rate leads to the formation of imprinted helical construction with different pitches. Pitch gradient inside the systems usually broaden the reflection band of sample cells effectively. After polymerization, the residual liquid crystal mixture was then removed by using solvent. Refilling of nematic liquid crystal increases refractive indexes leads to the enhancement of reflection light of sample cells. Stacking of two imprinted cells with different pitches broadens reflection band effectively. In this study, comparison of this new designed process with traditional UV polymerization process was carried out. Spectral characterizations and optical reflection of sample cells were performed using fiber optic spectrometer.

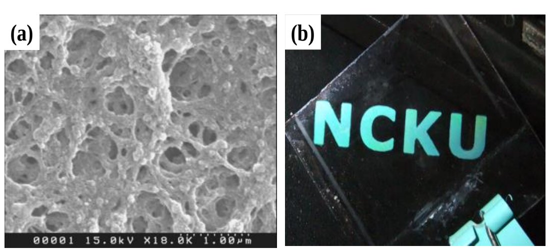

Fig. 1. (a) SEM of polymer matrices, and (b) real sample cell fabricated using the multiple UV-polymerizations.

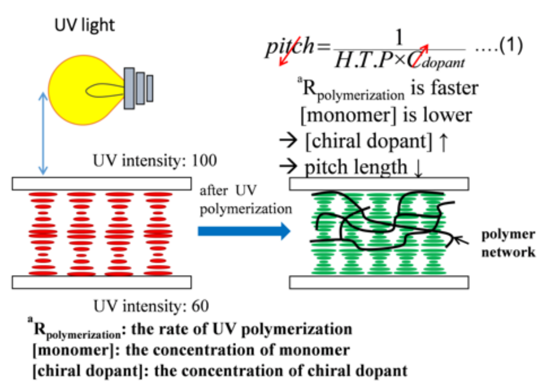

Fig. 2. Schematic illustration of the fabrication of broaden reflection band cells.

Speaker Biography

Jui-Hsiang Liu was bone in 1952 in Taiwan. He finished his master and Dr. Degrees at Osaka University, Japan. Currently, he is working as a full professor at the Department of Chemical Engineering, National Cheng Kung University, Tainan, Taiwan. His research interest is in the field of polymer science, optical materials, liquid crystalline materials, and chiral polymers.