Project Overview

Optical-Rewritable Liquid Crystal Displays (ORW LCD)
The recent display market has been saturated with LCD products. There exists a strong demand to improve the performance of LCD to a greater extent and solve the problems of alignment approaches. ORW LCD is a new technology to be developed using the Photo-alignment Technology. It has the advantages of:
- Using zero power consumption
- Rewrting images for a large number of times

Photo-response Time
The performance of ORW LCD is evaluated in terms of its photo-response time. It is defined as the orientation time of alignment direction during light exposure from bright state to dark state or vice versa.

Aim and Objectives
The goal of this project is to improve and maximize the performance of the rewritable alignment film (active alignment layer) in the ORW LCD. The alignment materials and fabrication conditions in producing ORW cells are varied in order to obtain the best response time.

Methodology

Stage 1: Alignment Approaches
For the active alignment layer, Photo-alignment was applied. It has advantages:
- Prevent impurities and mechanical damage
- Good optical characteristic

Stage 2: Mixing of Solutions
Pure 501, 502, 571 are considered for making bi- and tri-component mixtures, as these materials have good performance on a particular aspect.

Stage 3: Cell Fabrication

- Varying the Size of Spacer
  - Spacer forms a uniform gap between two glass films. The cell gap affects the optical anchoring energy of cells fabricated.

- Varying the Material of LC
  - Different liquid crystals vary the interaction between alignment layers and liquid crystals.

Stage 4: Parameter Measurement

- Varying the Spin-coating Time
  - Spin-coating applies uniform thin films to flat substrates by centrifugal force. The time for spin-coating can affect the uniformity and performance of the active substrate.

- Varying the Size of Spacer
  - 5 micron and 50 micron spacers were used to fabricate standard 501 cells.

- Varying Spin-coating Time
  - The best response time is 8.30 seconds with 50s spin-coating time

Results and Conclusion

Response Time Investigation

- (A) Varying Alignment Materials
  - Pure PDDI cells showed the best response times
  - The best response time is 5.59 seconds

- (B) Varying Baking Temperature
  - Standard 501 cells were fabricated with no baking, 40°C, 100°C, 140°C
  - The best response time is 10.37 seconds with no baking

- (C) Varying Spin-coating Time
  - Standard 501 cells were fabricated with spin-coating time 30s, 50s, 70s and 100s
  - The best response time is 8.30 seconds with 50s spin-coating time

Optimal Fabrication Condition
- (D) Varying the Materials of LC
  - Liquid crystals E7 and SCB were used to fabricate 501/502 mixtures cells.
  - Cells with SCB were generally faster than ones with E7 in response time.
  - Pure PDDI showed the best response time with 2.11 seconds using SCB.