열적 stress에 의한 폴리이미드 표면에서의 TN-LCD의 잔류DC 특성

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Residual DC characteristic on Twisted Nematic Liquid Display on the Polyimide Surface by the Thermal Stress

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Abstract

In this study, the threshold voltage and the response time of thermal stressed TN-LCDs showed the same performances on no thermal stressed TN-LCDs. There was little change of value in TN cells. Also, the transmittances of TN-LCDs on the rubbed PI surface were almost same while increasing thermal stress time. However, the thermal stability of TN cell was decreased by the high thermal stress for the long duration. Residual DC was decreased as the thermal stress increases. Especially, when TN cell was stressed more and more by heating, residual DC was changed a lot. As a result, the residual DC property of LCD in projection TV is affected very much by heating.

Key Words : transmittance, response time, polyimide(PI), twisted nematic(TN), residual DC, thermal stress

1. 서 론

Recently, thin film transistor (TFT)-liquid crystal displays (LCDs) have been widely used in information display devices such as notebook computers, desktop monitors and car navigation systems. It is critical that for the long duration, the function of the display should be maintained properly. So it is necessary to examine the problems coming from the long period display [1-2]. The major part of the study of the display stability is the thermal stability, above all, in the area of the projector type LCD. This projector type of LCD has low brightness on the ground of actualization principle. Therefore, to improve brightness, much too strong source of light is needed and this will induce intensively high heat around, causing the characteristics of the LCD to be deteriorated. But, thermal stability of LCD is not reported yet. Therefore, we support that LCD cell used the LCD projector and projection TV should quality about fast response and high thermal stability. In this paper, we designed to investigate the electro-optic change of LCD when exposed to intense heat and for the duration.

2. 실 험

In these experiments, the polymer (SE-7492,

Nissan Chemical Industries Co.) with side chains was used as a homogeneous alignment layer and as coated on ITO-coated glass substrates by spin-coatings, which were then imidized at 220℃ for 1 h. The thickness of the PI layers was 500Å. The PI films were rubbed by using a machine equipped with a nylon roller (Y_o-15-N, Yoshikawa Chemical Industries Co.). A definition of rubbing strength (RS) has been given in previous papers [3-8]. The RS used was 187 mm for the medium-rubbing region. The TN cell was used for the both-sides rubbed PI surfaces. The LC layer thickness of TN cells was set at 5 m. NLCs in positive dielectric anisotropy are used. TN cells was fabricated at room temperature, annealed at 100℃ during 6 hr and 12 hr for the measurement of thermal characteristics The voltage-dependent transmittance (V-T), response time and residual DC measurements were performed at room temperature (22℃). The EO characteristics were measured by using the LCD evaluation system. (LCD7000, Otsuka Co.), and the residual DC was measured by using the Residual DC Measurement System (RDMS-200, SEM, Co).

3. 결과 및 고찰

We investigated thermal ability of 90° TN-LCD. This ability in the LCD is important to evaluate the LCD duration because LCD in the projection TV was exposed by high temperature. All 90 TN cells had about 5.0㎛ cell gap. Figure 1 shows the microphotographs of the no stressed 90° TN cell and stressed 90° TN cell on the rubbed PI surface for 6 h and 12 h. The off-state alignment characteristic of the stressed 90° TN cell for 6 h and 12 h was a bit reduced, compared to that of no thermal stressed TN cell, as shown in Figure 1. It is shown that this was attributed to the increase of defects by the addition of thermal stress to the 90° TN cell. The transmittances of the 90° TN cells were almost same regardless of increasing of the thermal stress, as shown in Figure 2.

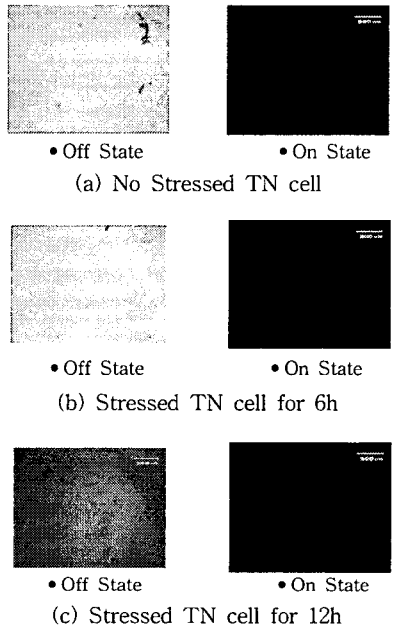

Fig. 1. Microphotographs of TN cell (in crossed Nicols); (a) No stressed TN cell, (b) Stressed TN cell for 6h, (c) Stressed TN cell for 12h.

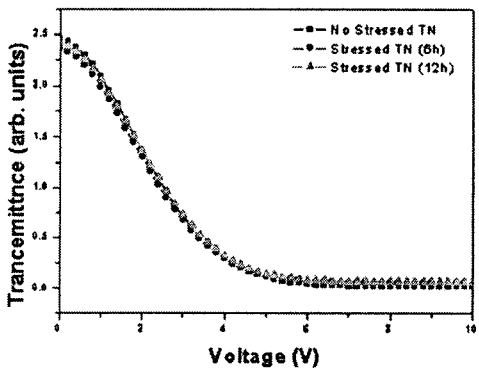

Fig.2. The V-T curves of no stressed 90°TN cell and stressed 90°TN cells for 6 h and 12 h on the rubbed PI surfaces.

Furthermore, response time characteristics of no stressed TN cell and stressed TN cells for 6 h and 12h on the rubbed PI surfaces were little

change of value, as shown in Figure 3.

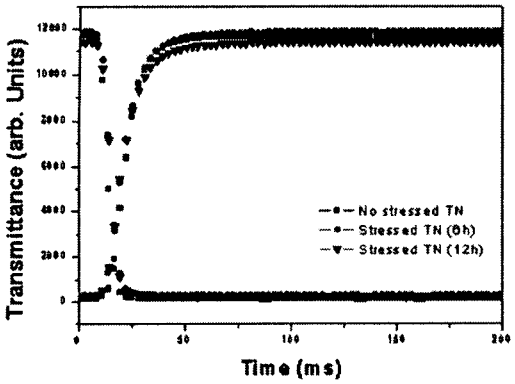

Fig. 3. The response time characteristics of no stressed TN cell and stressed TN cells for 6 h and 12 h on the rubbed PI surfaces.

However, this change of the response time is negligible enough to be considered the universal characteristic of LCD evaluation. Figure 4 shows the capacitance-voltage (C-V) characteristics of no stressed TN cell and stressed TN cells for 6 hr and 12 hr on the PI surfaces.

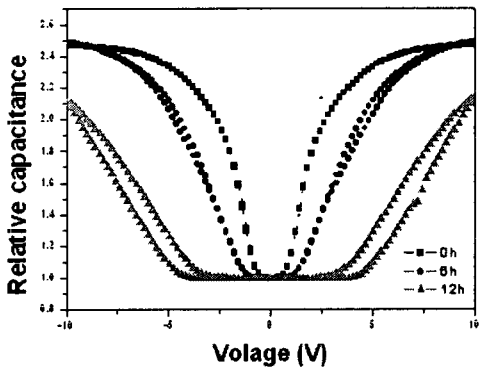

Fig. 4. The capacitance-voltage (C-V) characteristics of no stressed TN cell and stressed TN cells for 6 hr and 12 hr on the PI surfaces

As shown in the Figure 4, as the thermal stress duration increases, it is shown that the width of the hysteresis curve increases. The increase of the width of the hysteresis curve means the residual DC [1]. This characteristic of the residual DC is attributed to the ion impurities inside the LC. The ion impurities are absorbed to the surface of enshrined screen as the DC voltage is stressed and because of this ion absorbed to the enshrined screen, even then there is no voltage applied from the outside, the DC voltage is applied on the layer of the LC. Consequently the residual DC voltage depends on the LC, its operation, enshrined screen and the production method of the LC cell [2]. Therefore, as the continuous thermal stress is given to the LC cell, the movementof the impurities ion is active, contributing to the deteriorating the hysteresis characteristics. And at the same time this residual DC characteristics affect the flickering among other characteristics of the display. When the LCD runs for the duration, the electro-optic value of the threshold voltage, the vibration properties and so on was not affected, but the residual DC property was much affected. It is considered that these properties contribute to the deterioration of the display function afterwards.

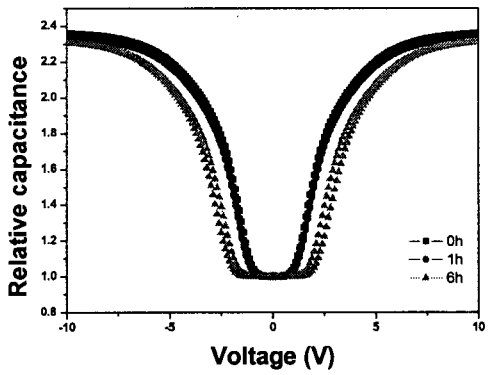

Fig.5. The capacitance-voltage (C-V) characteristics of no exposed TN cell and UV -exposed TN cell for 1h and 6h on the PI surfaces.

Figure 5 shows the capacitance-voltage(C-V) characteristics of no exposed TN cell and UV-exposed TN cell for 1h and 6h on the PI surfaces. As shown in the Fig. 5, the change of residual DC was a little. So, it was relatively good comparing with that of thermal stressed TN cell

4. 결 론

In this study, the threshold voltage and response characteristics by the TN cell of no thermal stress and the TN cell of the thermal stress showed the similar trends. Also the transmittance of the TN cell was almost same as the thermal stress increases. On the other hand, residual DC was decreased as the thermal stress increases. Especially, when TN cell was stressed more and more by heating, residual DC was changed a lot. As a result, the residual DC property of LCD in projection TV is affected very much by heating than UV.

감사의 글

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