P-94: Experimental Study on Reduction of Temporal Image Sticking Using Positive Biased- and Floated-Address Waveforms During Sustain Period in AC-PDP with MgCaO Protective Layer

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Abstract

In this paper, from the monitoring of the differences in the display luminance and color temperature, it was observed that the temporal image stickings when applying the positive biased- and floated-address waveforms during a sustain period of ac-PDP with MgCaO protective layer were mitigated in comparison with the grounded-address waveform.

1. Introduction

Recently, the temporal image sticking or image retention, where a residual image appears in the subsequent image when the previous image has been continuously displayed over a few minutes, is a critical issue that needs and urgent solution for the realization of a high image quality in internet protocol television (IPTV) or Smart TV, public information display (PID), and Electronic Copy-Board. Nonetheless, the temporal image sticking or image retention problems of PDPs remain a significant defect compared with other display devices (e.g. CRTs, LCDs, and OLEDs). Although the iterant strong sustain discharge during a sustain-period is known to induce an image sticking problem, the image sticking phenomenon is not still fully understood [1, 2, 3, 4]. Accordingly, this paper investigates the effects of the various address waveforms during a sustain period on the reduction of temporal image sticking from 6-in. test panel with the MgCaO protective layer. The positive biased- and floated-address waveforms during a sustain period are adopted to reduce the characteristics of the temporal image sticking. The resultant changes in the temporal image sticking characteristics, such as the display luminance and color temperature, were examined in comparison with the grounded-address waveform (Ref.).

2. Experimental Setup

Fig. 1 shows the optical-measurement systems and 6-in. ac-PDP with three electrodes used in the experiments, where X is the sustain electrode, Y the scan electrode, and A the address electrode. The MgCaO protective layer was used in this study. The cell size of 6-in. ac-PDP was used 50-in. full-HD (FHD) cell size. A color analyzer (CA-100) and signal generator were used to measure the luminance and color temperature, respectively. The gas chemistry and pressure in the 6-in. test panel were Ne-Xe (11 %)-He (35 %) and 430 Torr, respectively. The detailed panel specifications are listed in Table 1. As shown in Fig. 1, the area of the square-shaped pattern is the discharge region and another area is the nondischarge region. To produce a residual image caused by the temporal image sticking, the entire region of the test panel was then abruptly changed to a full-white background image after

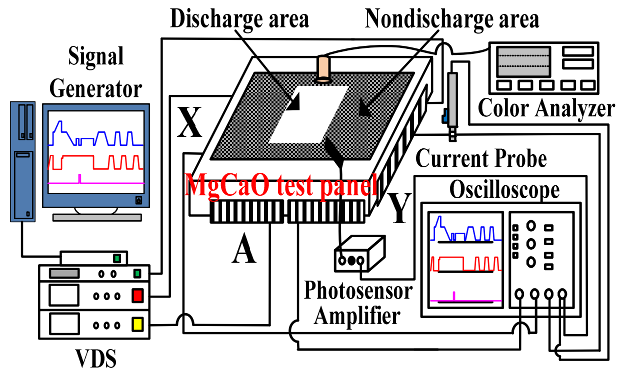

Fig. 1. Schematic diagram of experimental setup employed in this research.

Table 1. Specifications of 6-in. AC-PDP with 50-in. FHD cell size used in this research

Front Panel		Rear Panel	
ITO width	210 μm	Barrier rib width	50 μm
ITO gap	70 μm	Barrier rib height	120 μm
Bus width	70 μm	Address width	85 μm
Pixel Pitch		576 × 576 μm	
Gas chemistry		Ne-Xe (11 %)-He (35 %)	
Gas pressure		430 Torr	
Barrier rib type		Closed rib	
Protective layer		MgCaO	

displaying a square-type image (discharge area) for about 5-min. sustain discharge. Fig. 2 (a) shows the conventional driving waveform including the reset, address, and sustain periods. Figs. 2 (b)-(e) show the grounded-, positive biased-, floated-address waveforms during a sustain period used in this study. The frequency and the duty ratio for the sustain period were 200 kHz and 50 %, respectively. The sustain voltage was 205 V. As shown in Fig. 2, the grounded- (Ref.), positive biased- (AC 60 V and DC 60 V), and floated-address waveforms were applied to the address electrode during a sustain period, respectively.

 ISSN 0097-966X/11/4203-1462-$1.00

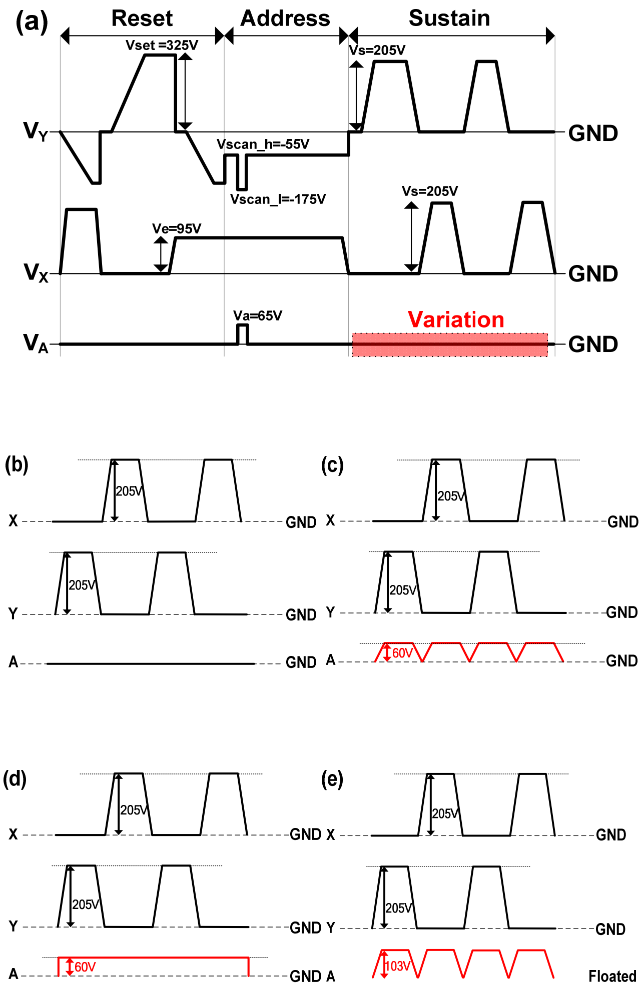

Fig. 2. Schematic diagram of (a) conventional (Ref.) driving waveform (including reset, address, and sustain periods), (b) grounded-address (Ref.), (c) positive biased AC 60V, (d) positive biased DC 60V, and (e) floated-address waveforms during sustain period used in this study.

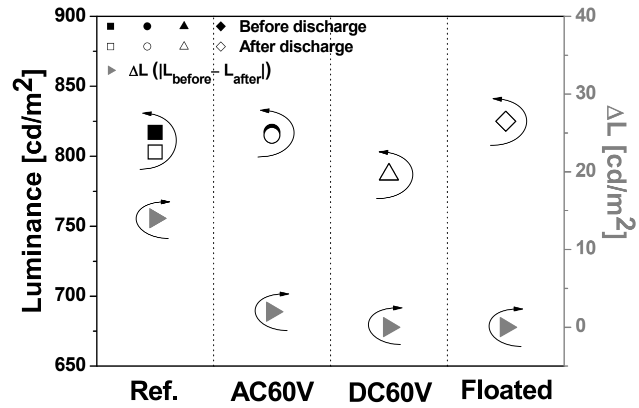

Fig. 3. Changes in luminance and luminance difference (Δ L) measured before and after 5-min. sustain discharge in discharge region when applying grounded- (Ref.), positive biased-, and floated-address waveforms during sustain period.

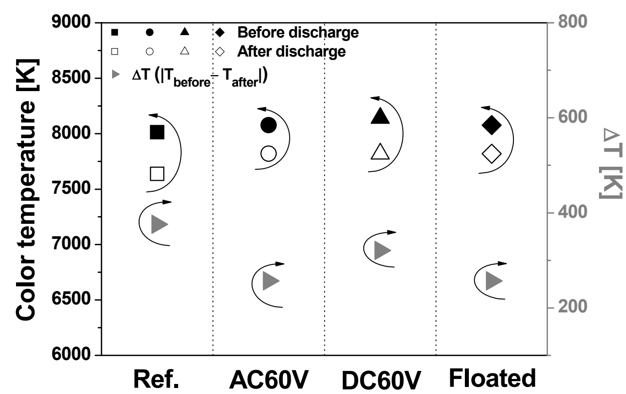

Fig. 4. Changes in color temperature and color temperature difference (Δ T) measured before and after 5-min. sustain discharge in discharge region when applying grounded- (Ref.), positive biased-, and floated-address waveforms during sustain period.

3. Experimental Results and Discussion

Fig. 3 shows the changes in the luminance and luminance difference (Δ L) before and after 5-min. sustain discharges in the discharge region when applying the grounded- (Ref.), positive biased-, and floated-address waveforms during a sustain period. As shown in Fig. 3, in both cases of the application of positive biased- and floated-address waveforms to the address electrode, the differences in the luminance before and after sustain discharges were reduced in comparison with the grounded-address waveform in spite of the increase in the luminance characteristics.

Fig. 4 shows the changes in the color temperature and color temperature difference (Δ T) before and after 5-min. sustain discharges in the discharge region when applying the grounded- (Ref.), positive biased-, and floated-address waveforms during a sustain period. As shown in Fig. 4, in both cases of the application of positive biased- and floated-address waveforms to the address electrode, the differences in the color temperature before and after sustain discharges were reduced in comparison with the grounded-address waveform.

Consequently, the date in Figs. 3 and 4 indicated that the temporal image sticking when applying the positive biased- and floated-address waveforms was reduced. This result indicates that the positive biased- and floated-address waveforms during a sustain period contribute to reducing the temporal image sticking.

4. Conclusion

In this paper, the effects of the grounded-, positive biased-, and floated-address waveforms during a sustain period on the temporal image sticking were investigated and compared in a 6-in. test panel (50-in. FHD cell size) with the MgCaO protective layer. Based on the experiment data obtained, such as the differences in luminance and color temperature, the temporal image sticking was observed to have been reduced when applying the positive biased- and floated-address waveforms. Thus, it is expected that these experimental results will help reduce the problem of temporal image sticking in FHD PDP-TVs.

5. References

[1] Ho-Jun Lee, Dong-Hyun Kim, Young-Rak Kim, Myoung-Soo Hahm, Don-Kyu Lee, Joon-Young Choi, Chung-Hoo Park, Jae-Wha Rhyu, Jung-Kyun Kim, and Sang-guk Lee, "Analysis of temporal image sticking in ac-PDP and the methods to reduce it," *SID'04 Digest*, pp.214-217, 2004.

[2] Heung-Sik Tae, Choon-Sang Park, Byung-Gwon Cho, Jin-Won Han, Bhum Jae Shin, Sung-Il Chien, and Dong Ho Lee, "Driving waveform for reducing temporal dark image sticking in AC plasma display panel based on perceived luminance," *IEEE Trans. Plasma Science*, Vol. 34, No. 3, pp.996-1003, 2006.

[3] Choon-Sang Park and Heung-Sik Tae, "A study on temporal dark image sticking in ac-PDP using vacuum-sealing method," *IEICE Trans. Electronics*, Vol. E92-C, No. 1, pp.161-165, 2009.

[4] Choon-Sang Park, Sun Ho Kim, Jae-Hyun Kim, and Heung-Sik Tae, "Reduction of temporal image sticking in ac plasma display panels through the use of high He contents," *Journal of Information Display*, Vol. 10, No. 4, pp.195-201, 2009.