Study on Image Retention in an AC Plasma Display Panel

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Abstract

Image retention is a kind of fatal shortcoming of the AC PDPs for realizing high-quality picture. In this work, the measurement method of image retention was proposed using temporal measurement of luminance, CIEXYZ tristimulus values, IR emission of reset pulse, and temperaturel. On the base of temporal measurement of luminance, CIEXYZ tristimulus value, and IR emission of reset pulse , the retention time of Ne+5%Xe gas-mixture discharge was about 2 hours after white window image. However, it was about 20 minute on the base of temporal measurement of temperature.

1. Introduction

In an AC PDP, there are several types of image defects such as image retention, image sticking, image shadowing, image smearing, and image streaking [1]. These kinds of image defect are one of the obstacles to realize high-quality picture in a high definition AC PDP TV. Among them, the image retention is the continued presence of a weak image after a bright image is removed[1]. Several papers reported the image retention qualitatively, but they did not show why image retention was occurred in an AC PDP[2,3]. The standard quantized measurement method should be defined to investigate the image retention. T.Bignon suggested the quantitative measurement of image sticking using luminance ratio[4]. However, the only measurement of luminance was not enough to explain the image retention and sticking. In our previous report, temperature was thought to be related to the image sticking[5]. In this work, the measurement method of image retention was proposed to investigate the cause the image retention using the temporal behaviors of luminance, CIEXYZ tristimulus values, IR emission of reset pulse, and temperature.

2. Experimental Setup

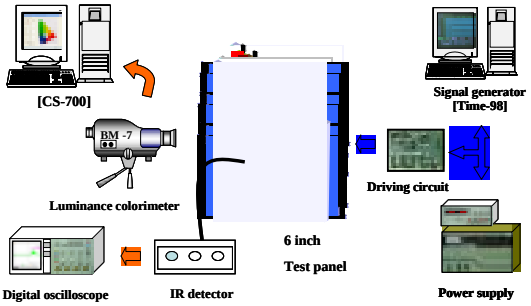


Fig1. Schematic diagram of experimental setup

Fig.1 shows the schematic diagram of the experimental setup. The measurement systems are mainly consisted of luminance colorimeter (BM7), IR detector, and driving circuits. The 6-inch test panel with the stripe and the closed type barrier rib structure, respectively, was used and its gas mixture was Ne+5%Xe. The frequency of sustain pulses was 100 kHz. The voltage of sustain, reset, and address was 180V, 360V, and 90V, respectively.

The test image pattern for measuring the image retention is shown in Fig.2. The black region (labeled in A) is the black level, where only reset discharges were continuously occurred. The white region (labeled in B) is the white level, where reset discharges and

sustain discharges were occurred during few minutes. Thereafter, region B was turned to a black level as like region A. The luminance, the CIEXYZ tristimulus values, and the IR emission of reset pulse, and the temperature of region B at black level just after white level were measured as a function of time.

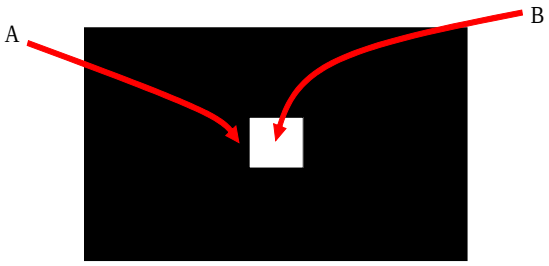


Fig.2 Test image pattern for measuring the image retention

3. Results and discussion

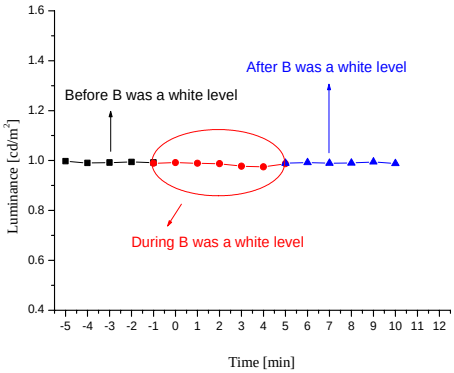
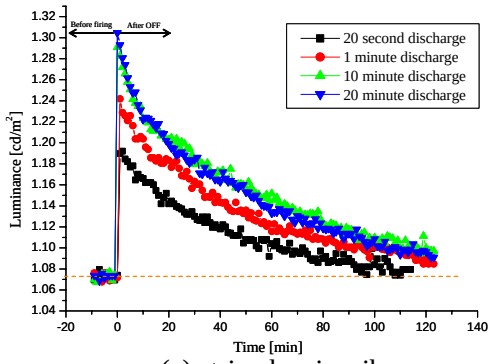


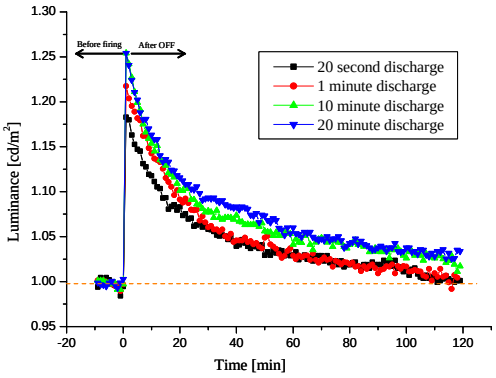
Fig.3 Luminance of region A at black level as a function of time

Fig.3 shows the luminance of region A as a function of time before, during , and after white level of region B. As shown in Fig.3, there was no variation of the luminance in region A. Therefore, we can infer that there was no image retention in region A. However, we could observe the image retention in region B.

Fig.4 shows the temporal variation of the luminance of area, "B", at black level after white level in accordance with structure. The time in the box of Fig.4 is defined as the elapsed time when region B was turned to a black level. The luminance of region B was recovered to that of region A after 2 hours.



(a) stripe barrier ribs



(b) closed barrier ribs

Fig.4 Temporal variation of luminance of area, "B", at black level after white level

Fig.5 shows the temporal variation of the CIEXYZ tristimulus values of region B at the black level just after white level. As shown in Fig.5, the variation of tristimulus value was similar to that of luminance.

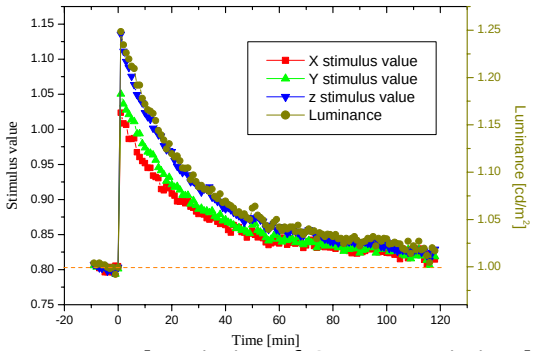


Fig.5 Temporal variation of CIEXYZ tristimulus values of area, "B", at black level after white level

Fig.6 shows the reset waveform and its IR emission during reset period. We measured the voltage (hereafter peak voltage) when the IR emission has its peak intensity during ramp up("a" in Fig.6) and down("b" in Fig.6) period.

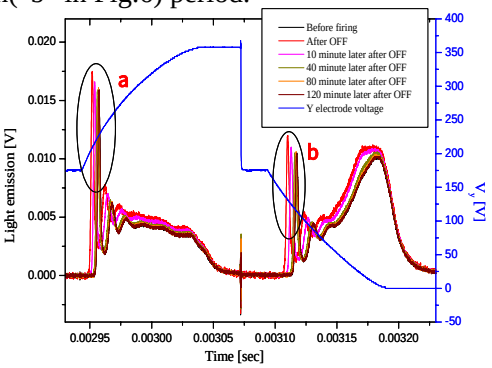
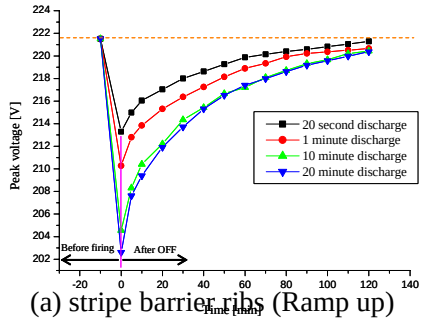
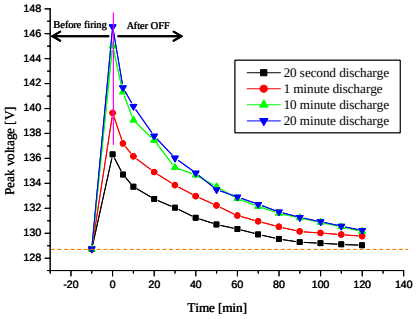


Fig.6 Reset waveform and its IR emission during reset period

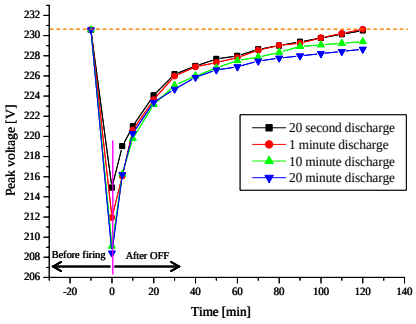
Fig. 7 shows the temporal variation of the peak voltage of area, "B", at black level after white level in accordance with structure during ramp up and down period. The peak voltage of region B was recovered to initial state after 2 hours



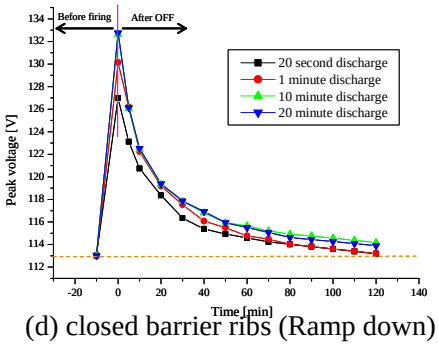
(a) stripe barrier ribs (Ramp up)



(b) stripe barrier ribs (Ramp down)

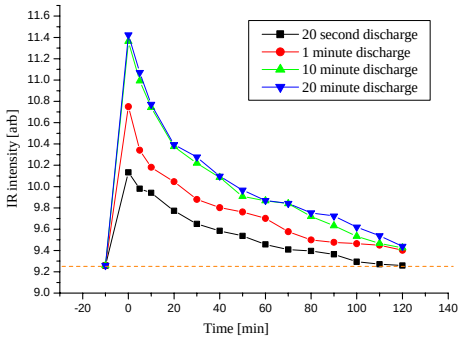


(c) closed barrier ribs (Ramp up)

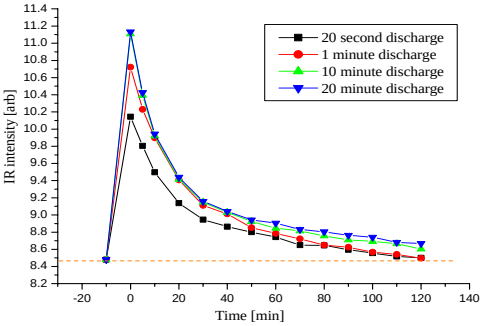


(d) closed barrier ribs (Ramp down)

Fig.7 Temporal variation of the peak voltage of area, "B", at black level after white level



(a) stripe barrier ribs



(b) closed barrier ribs

Fig.8. Temporal variation of the IR intensity of reset pulse of area, "B", at black level after white level

Fig. 8 shows the temporal variation of IR intensity of reset pulse of area, “B”, at black level after white level. As shown in Fig 8, the variation of IR intensity shows the same behavior with that of the luminance and peak voltage.

Discharge time			20 sec	1 min	10 min	20 min
Firing voltage (V)	Ramp up	stripe	-8.22	-11.23	-16.95	-18.9
		closed	-15.64	-18.62	-21.5	-22.12
	Ramp down	stripe	7.57	10.9	16.27	17.82
		closed	13.98	17.14	19.64	19.76
IR intensity (arb)		stripe	0.8747	1.4925	2.1047	2.1658
		closed	1.6651	2.2429	2.6302	2.6523
Luminance (cd/m^2)		stripe	0.1165	0.1687	0.2177	0.2316
		closed	0.1853	0.2199	0.2565	0.2566

Table 1 Relative variation of peak voltage and IR intensity of reset pulse, and luminance after temporal white level

Table 1 shows the relative variation of the peak voltage, IR intensity, and luminance as a function of the time when the region B was turned white level into black level. As shown Table 1, the variation of the peak voltage, the IR intensity, and the luminance of the closed barrier ribs were greater than those of the stripe barrier ribs because of the difference of the panel temperature during the discharges.

Fig.9 shows the variation of the panel temperature area, “B”, at black level as a function of the time after the white level was continuously displayed for 25minutes. As shown Fig.9, the saturated temperature of the closed barrier ribs was higher than that of stripe barrier ribs. This result shows the time scale of the image retention, which is roughly 20 minutes.

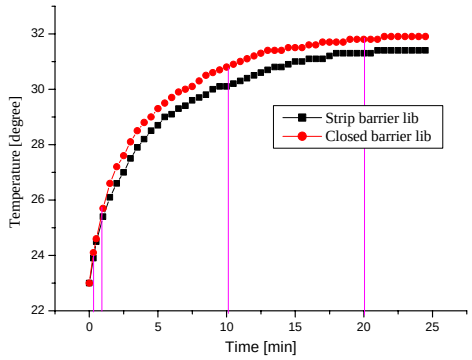


Fig. 9 Temporal variation of the panel temperature of area, “B”, at black level after white level in accordance with structure

4. Conclusion

The temporal measurement method of image retention was proposed using luminance , CIEXYZ tristimulus value, peak voltage and IR intensity of reset pulse, and temperature. The temporal behaviors of luminance and CIEXYZ tristimulus value are similar to those of peak voltage and IR intensity of reset pulse. On the based of temporal measurement of luminance, CIEXYZ tristimulus, and peak voltage and IR intensity of reset voltage, the image retention time was about 2 hours. It was about 20 minute when the temporal measurement of temperature was used. We do not exactly know the difference between the temperature and the IR measurement method. However, it is found that the decay tendency of luminance, CIEXYZ tristimulus, and peak voltage and IR intensity of reset voltage is similar to the recovery tendency of temperature. From the results, the mechanism of the image retention of an AC PDP was thought to be as follows; The firing voltage of the reset pulse decreases as the temperature of temporal image increase. Therefore, IR emission intensity becomes stronger. Consequently, the luminance and CIEXYZ tristimulus value are changed. We can see the difference of the luminance and the CIEXYZ tristimulus value between before and after the temporal white image.

5. References

[1]IEC 61988-1, Ed.1: Plasma Display Panels-Part1: Terminology and Letter symbols, 2003.

[2]Jin-Won Han, Byung-Gwon, and Ki-Hyung Park, “Temporal Image Sticking Phenomena in AC-PDP with Large Sustain Gap”. IDW’04, pp965~968, 2004.

[3]Ho-Jun Lee, Dong-Hyun Kim, Young-Rak Kim, Myoung-Soo Hahm, “Analysis of Temporal Image Sticking in ac-PDP and Methods to Reduce It”. SID’04 DIGEST, pp214-217, 2004.

[4]T.Bignon, P.Boher, V.Gibour, T.Leroux, “Image Sticking Cartography on PDP TV: A Quantitative Measurement”, SID’05, pp598-601, 2005.

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