

# Negative Sustain Waveform for Reducing Temporal Image Sticking in AC Plasma Display Panel

**Sang-Yup Kim, Choon-Sang Park, and Heung-Sik Tae**

School of Electronics Engineering, College of IT Engineering, Kyungpook National University, 1370 Sankyuk-dong, Buk-gu, Daegu 702-701, Korea

## ABSTRACT

The temporal image sticking characteristics on the bright screen produced by a negative sustain waveform were examined in comparison with those produced by a positive sustain waveform. The temporal image sticking characteristics are strongly related to the ion bombardment onto the phosphor layer during an iterant strong sustain discharge. It was observed that the temporal image sticking when applying the negative sustain waveform was reduced in comparison with the positive sustain waveform.

## 1. INTRODUCTION

Despite the suitability of flat panel devices for digital high definition televisions, plasma display panel (PDPs) still suffer from the critical problem known as temporal image sticking, which is the residual image or ghost image that remains in a subsequent image when the previous image was continuously displayed over a few minutes [1], [2]. It is already known that temporal image sticking is caused by the iterant strong sustain discharge that causes decrease of visible-conversion by the deposition Mg species on the phosphor [3] and the severe aggravation of the phosphor layer by the ion bombardment when displaying an image. Accordingly, this paper investigates the relation between the temporal bright image sticking and negative sustain waveform [4], [5] from ac-PDP.

## 2. EXPERIMENTAL SETUP

Fig. 1 shows a schematic diagram of the optical and electrical measurement system used in this study. A color analyzer (CA-100), photosensor amplifier (Hamamatsu C6386), and signal generator were used to measure the luminance, color temperature, and IR emission of the test panel with the two different sustain waveforms, respectively. The gas chemistry and pressure in the 7-in. test panel were Ne-Xe (10%) and 420 Torr. Fig. 2 shows the sustain waveforms employed in this study. The positive and negative sustain voltages were 200V and -200V, respectively. The frequency and the duty ratio for the sustain period were 200 kHz and 50 %, respectively. To produce a residual image caused by the temporal image sticking, the entire region of the test panel was abruptly changed to the bright screen immediately after the 5-min. sustain discharge.

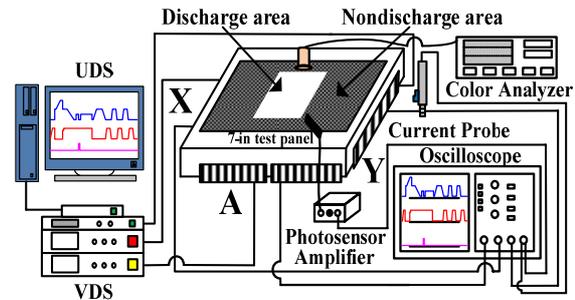


Fig. 1 Schematic diagram of experimental setup employed in this research.

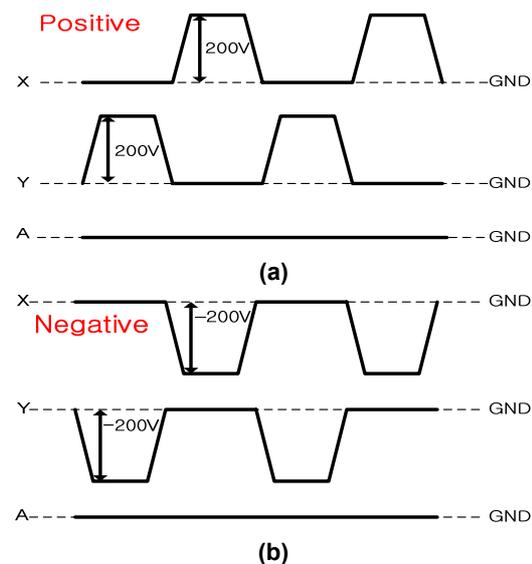
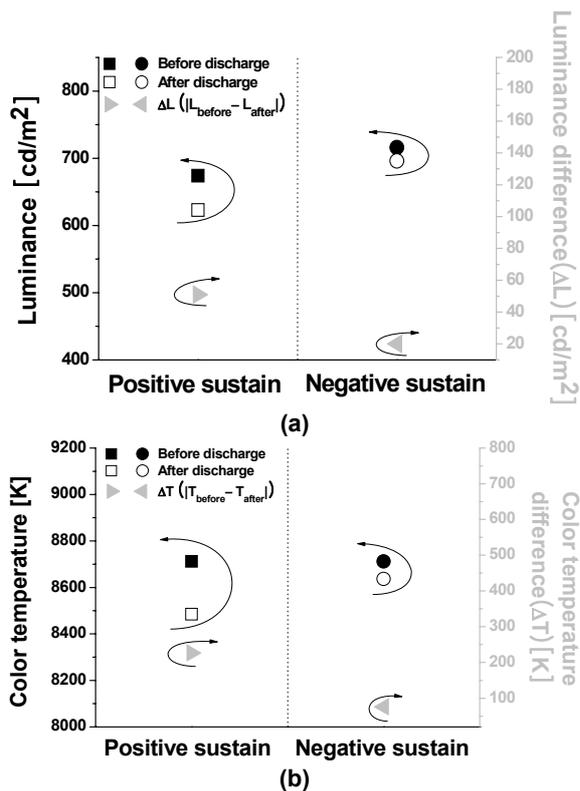


Fig. 2 Sustain waveforms ((a) positive (conventional) and (b) negative sustain waveforms) employed in this study.

## 3. EXPERIMENTAL RESULTS

Fig. 3 shows the changes in the luminance and the color temperature before and after 5-min. sustain discharge on a bright screen when applying the positive and negative sustain waveforms. As shown in Fig. 3 (a), when applying the negative sustain waveform, the difference in luminance was reduced in comparison with the positive sustain waveform in spite of the increase in the luminance characteristics. As shown in Fig. 3 (b), when applying the negative sustain waveform, the difference in color temperature was also reduced.

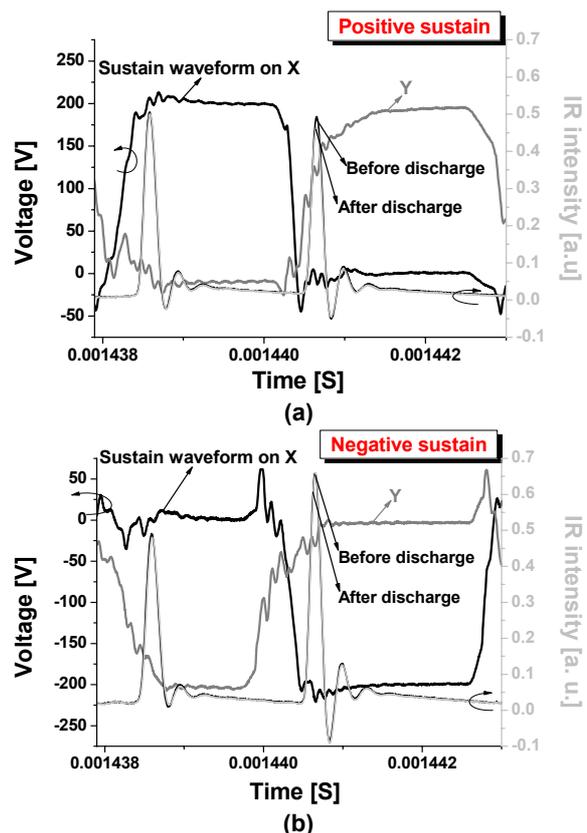


**Fig. 3** Changes in (a) luminance and (b) color temperature measured before and after discharge in discharge region when applying positive and negative sustain waveforms.

It indicated that the temporal image sticking when applying the negative sustain waveform was reduced. Fig. 4 shows the changes in IR emissions (828 nm) measured before and after 5-min. sustain discharge in the discharge region during the sustain period when applying the positive and negative sustain waveforms. When the IR emissions before and after discharge were compared, the differences in IR emission were observed. In particular, as shown in Fig. 4 (a), the IR emissions showed quite different peaks when applying the positive sustain waveform. However, as shown in Fig. 4 (b), the ignition time and peak of the IR emissions were observed to have no difference between the before and after discharge when applying the positive sustain waveform. This result indicates that the negative sustain waveform contributes to reducing the temporal image sticking.

#### 4. CONCLUSIONS

The effects of positive and negative sustain waveforms on the temporal image sticking were investigated and compared in a 7-in test panel with a Ne-Xe (10%) gas mixture at 200 kHz. Based on the experiment data obtained, such as the differences in luminance, color temperature, and IR emission, the temporal image sticking was observed to have been reduced when applying the negative sustain waveform. Thus, it is expected that the



**Fig. 4** Changes in IR emission measured before and after discharge in discharge region when applying (a) positive and (b) negative sustain waveforms.

negative sustain waveform will help reduce the problem of temporal image sticking in ac PDP-TVs.

#### REFERENCES

- [1] C.-S. Park, S. H. Kim, J.-H. Kim, and H.-S. Tae, "Reduction of Temporal Image Sticking in AC Plasma Display Panels through the Use of High He Contents," *Journal of Information Display*, pp. 195-201, Vol. 10, No. 4 (2009)
- [2] C.-S. Park and H.-S. Tae, "A Study on Temporal Dark Image Sticking in AC-PDP Using Vacuum-Sealing Method," *IEICE Trans. Electronics*, pp. 161-165, Vol. E92-C, No. 1 (2009)
- [3] Y. G. Han, S. B. Lee, S. H. Jeong, C. G. Son, N. L. Yoo, H. J. Lee, J. E. Lim, J. H. Lee, J. M. Jeoung, B. D. Ko, P. Y. Oh, M. W. Moon, and E. H. Choi, "A study of characteristics for image sticking in AC-Plasma Display Panel," *IMID'05 Digest*, pp. 263-265 (2005)
- [4] J. K. Lim and H.-S. Tae, "Negative Sustain Waveform for Improving Discharge Characteristics in AC Plasma Display Panel," *IEEE Trans. Electron Devices*, pp. 2595-2601, Vol. 55, No. 10 (2008)
- [5] J. W. Kang, "Characteristic of a Negative Driving Waveform in ac PDPs," *IMID'09 Digest*, pp. 97-100 (2009)