P.16: Analysis of Discharge Characteristics Based on Vt Close Curve in AC Plasma Display Panel with Ridged Dielectric Structure

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Abstract

The discharge characteristics of a ridged dielectric structure, especially such as a firing voltage and related wall voltage, are investigated by measuring the Vt close curve. Due to the changes in the firing discharge characteristics of the ridged dielectric structure between the two sustain electrodes, the conventional reset waveform including the address waveform needs to be modified. Based on the Vt close curve analysis, the modified driving waveform suitable for the ridged dielectric structure is proposed and examined under the 42-in. PDP.

1. Introduction

The luminous efficiency of plasma display panel must be further improved for the successful realization of large size display device. Lots of researches for improving the luminous efficiency have focused on producing positive column using very large sustain gap [1] and increasing of the Xe gas mixture in the small sustain gap structure [2]. Recently, one of the methodsF for improving luminous efficiency is using the PDP with ridged dielectric layer [3] under a high Xe gas mixture. However, the discharge characteristics of the ridged dielectric structure (hereinafter ridge structure) have not been understood completely so far. To investigate the effects of the ridge structure without dielectric layer between the two sustain electrodes on the discharge characteristics, especially such as a firing and wall voltage, the Vt close curve analysis [4], which has been known as a powerful analysis tool in PDP, was used. In particular, the discharge characteristics between the conventional and ridge structures are compared and analyzed by using the Vt close curve measurement technique. As the cell voltage difference between the sustain (X) and scan (Y) electrodes in the ridge structure is lower than that of the conventional structure, the conventional driving waveforms including the reset and address waveform is thought to be unsuitable for the ridge structure. Accordingly, this paper investigates the effects of discharge characteristics such as a firing and wall voltage in the conventional and the ridge structures based on the Vt close curve analysis. When adopting the modified driving waveform, the address discharge time lags are examined and compared with those when using the conventional driving waveform in the ridge structure.

2. Ridged dielectric structure

Figs. 1 (a) and (b) show the schematic diagram of the 42-in. AC-PDP with (a) conventional dielectric layer and (b) the ridged layer of 110 μm under the high Xe gas mixture [Ne-Xe (15 %)]. Other conditions were the same for both structures. The width of the address electrode (A) was 150 μm and the height of the close type barrier rib was 120 μm.

Fig. 2 shows the Vt close curves measured from the conventional and ridge structures. The horizontal axis indicates the threshold voltage between the sustain (X)

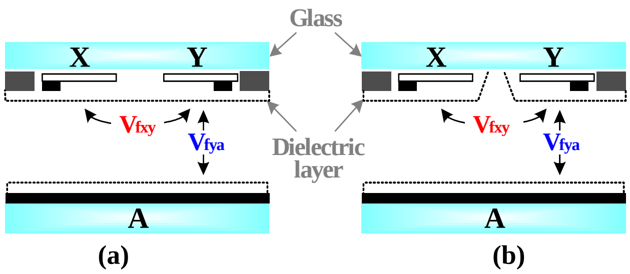

Fig. 1. (a) conventional and (b) ridged dielectric structure of 42-in. plasma display panel.

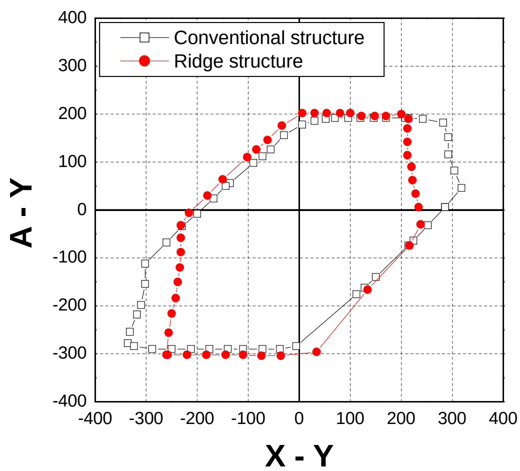

Fig. 2. Comparison of Vt close curves between conventional and ridged dielectric structures.

and scan (Y) electrodes, whereas the vertical axis indicates the threshold voltage between the address (A) and scan (Y) electrodes. The typical Vt close curve shape in the conventional panel structure is a hexagon with six sides [4]. As shown in Fig. 2, the threshold voltage between the X and Y electrodes in the ridge structure was lower than that of the conventional structure, whereas the threshold voltage between the A and Y electrodes was the same as the conventional panel structure. This result means that the conventional driving waveforms including the reset and address waveform need to be modified to be suitable for the ridge structure.

3. Experimental Results

3.1 Conventional Driving Waveform

Fig. 3 shows conventional driving waveforms including a reset, address, sustain-periods for applying the conventional and ridge structure panels. The applied voltages were shown in Table 1. All of the voltage levels except the bias voltage applied to the X electrode were the same for both the conventional and ridge structures. For the ridge structure, the bias voltage applied to the X electrode was lower than that of the conventional structure because the firing voltage between the X and Y electrodes was different. If the voltage applied to the ridge structure was increased over 80 V, the misfiring between the X and Y electrodes was produced.

Fig. 4 illustrates the IR emission waveform during the application of the scan voltage when applying the conventional driving waveform to the (a) conventional and (b) the ridge structures. It was found that the address discharge time lags for the ridged dielectric structure was delayed compared with those of the conventional structure.

This address discharge time lag phenomenon for the ridge structure can be explained by analyzing the voltage vector behavior on the Vt close curve shown in Figs. 5 (a) and (b). When the ramp waveform was applied to the Y electrode [step (1)], as shown in Fig. 3, the A-Y discharge was initially produced in the conventional structure (a), whereas the X-Y discharge was initially produced in the ridge structure (b). That means that the large amount of wall charges were accumulated on the A electrode in the conventional structure, compared with the ridge structure. In steps (2) and (3), though the voltage level changes abruptly on the X and Y electrodes, any discharge was not produced because the voltage vectors moved within threshold voltage. Finally, by applying the falling ramp waveform to the Y electrode [step (4)] in the conventional structure, the cell voltage moved to near the threshold voltage for producing the address discharge between the A and Y electrodes. However, in the ridge structure, the cell voltage moved to the lower position compared with the conventional structure, thereby resulting in delaying the address discharge time lags.

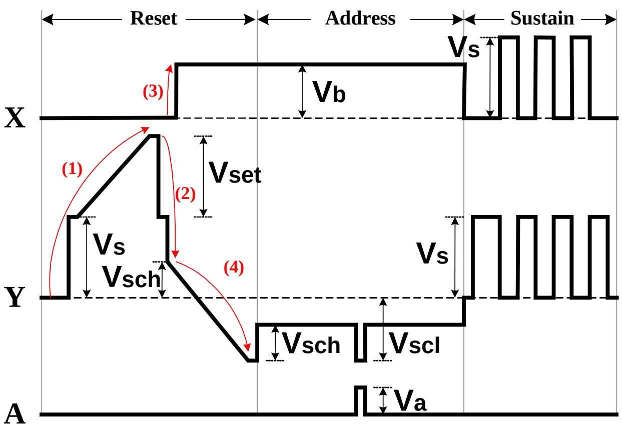

Fig. 3. Conventional driving waveform including reset, address, sustain-periods for applying conventional and ridge structures.

Table 1 Voltage level of Fig. 3 applying to conventional and ridge structures.

<table>
<tr><th>Panel</th><th>Vs</th><th>Vset</th><th>Vsch</th><th>Vscl</th><th>Vb</th><th>Va</th></tr>
<tr><td>Conventional</td><td rowspan="2">200</td><td rowspan="2">200</td><td rowspan="2">80</td><td rowspan="2">-160</td><td>150</td><td rowspan="2">70</td></tr>
<tr><td>Ridge</td><td>80</td></tr>
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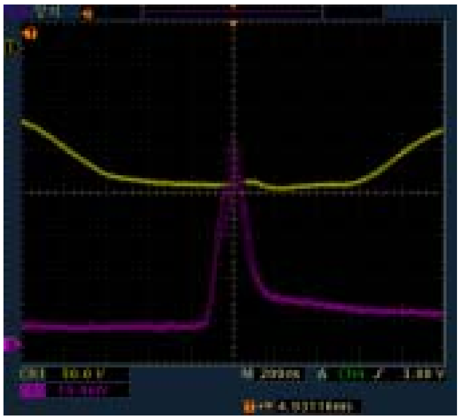
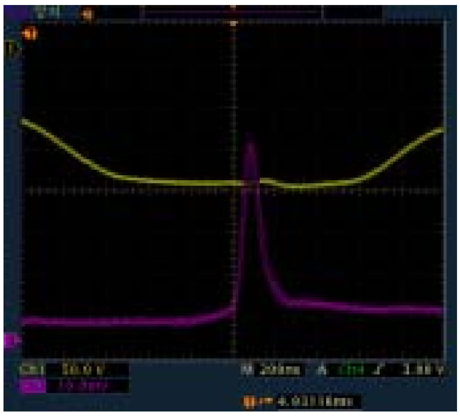
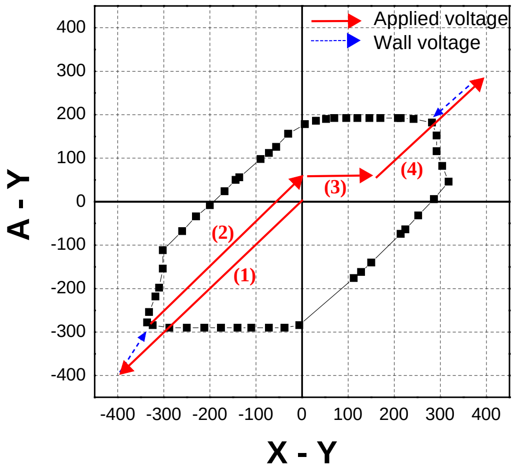


(a)

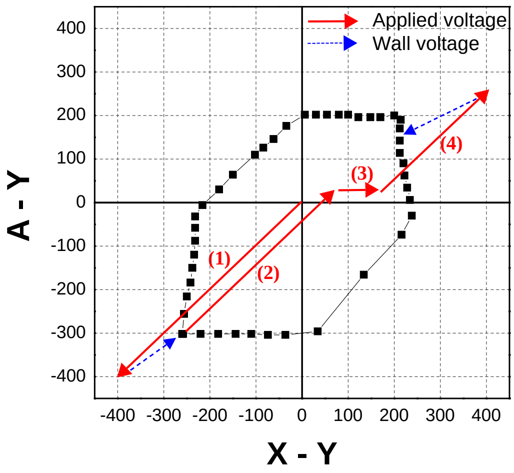


(b)

Fig. 4. Comparison of IR emission waveform when applying the conventional driving waveform to (a) conventional with Vb of 150 V and (b) ridge structure with Vb of 80 V.



(a)



(b)

Fig. 5. Voltage vector behavior on Vt close curve when applying conventional driving waveforms to (a) conventional and (b) ridged dielectric structures.

3.2 Proposed driving waveform

To move the cell voltage position to the upper side, the modified driving waveform was proposed in Fig. 6, and the corresponding voltage vector behavior on the Vt close curve was shown in Fig. 7. The scan low voltage applied to the Y electrode and the bias voltage applied to the X electrode during an address-period was shifted down than that of the conventional driving voltage.

In Fig. 8, the address discharge characteristics were improved when applying the proposed driving waveform in comparison with those when applying the conventional driving waveform in the ridge structure of Fig. 4 (b).

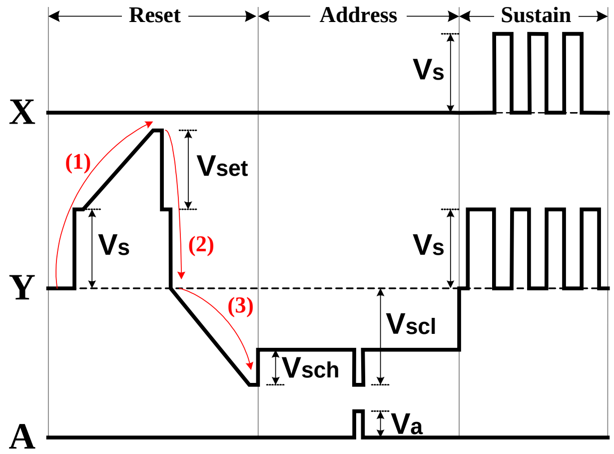


Fig. 6. Proposed driving waveform for improving address discharge characteristics in ridged dielectric structure.

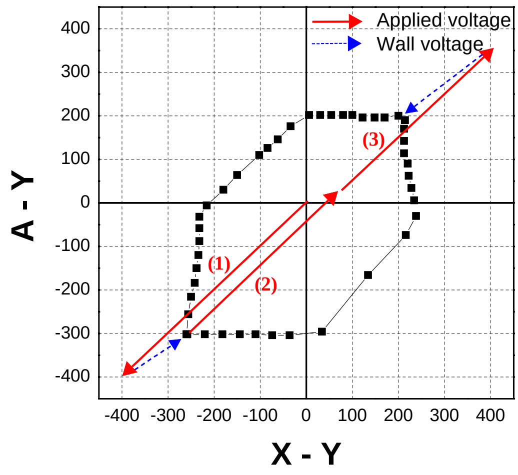


Fig. 7. Voltage vector behavior on Vt close curve when applying proposed driving waveform to ridged dielectric structure.

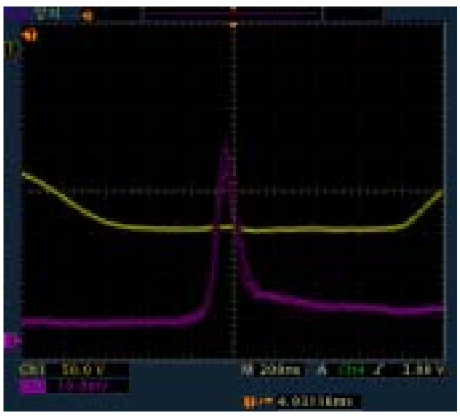


Fig. 8. Address discharge characteristics when applying the conventional driving waveform to ridged dielectric structure.

5. Conclusion

This paper investigated the effects of the ridged dielectric structure between the sustain electrodes on the discharge characteristics, especially such as a firing and wall voltage by using the Vt close curve analysis. As a result, the new driving waveform suitable for the ridged dielectric structure is designed and its improved discharge characteristics are examined.

6. References

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