37.4: Analysis on Address Discharge Characteristics of MgO Layer with MgO Single Crystal Powder under Various Panel Temperatures in AC-PDP

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Abstract

It is known that the statistical delay time is improved drastically by using the MgO single crystal powders, irrespective of variable panel temperature. In this paper, to analyze the effects of the electric field on the emission characteristics of the MgO layer with MgO single crystal powder, the variations in the wall voltage induced by the electron emissions were measured relative to the electric field intensity between the A-Y electrodes during address period. The measurement result confirms that the electron emission characteristics of the MgO layer with MgO single crystal powder strongly depend on the electric field intensity instead of the panel temperature.

1. Introduction

Recently, it has been reported that the MgO layer was very important role in the address discharge as well as the sustain discharge. However, as panel temperature decreased, the address discharge characteristics, especially the statistical delay time, was considerably aggravated under conventional MgO layer. Accordingly, the single crystal powder was additionally used as the functional layer in order to overcome the demerits of MgO layer. In this case, the statistical delay time was improved considerably under various panel temperatures [1, 2]. Nevertheless, the detailed reason for the improvement of statistical delay time is not clear. Accordingly, this paper focuses on the significant factor for inducing the improvement of the statistical delay time, especially under the low panel temperature in the case of adopting the MgO single crystal powder.

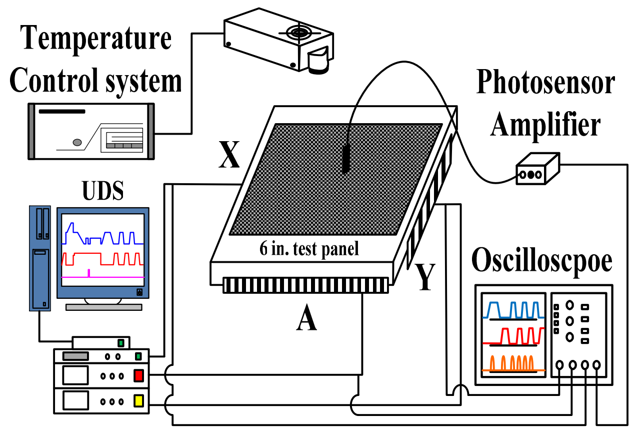

Figure 1. Schematic diagram of experimental setup in this study.

2. Experimental Setup

Fig. 1 shows optical-measurement system and 6-inch test panel with three electrodes used in the experiment, where X is the sustain electrode, Y is the scan electrode, and A is the address electrode. The cell size of 6-inch test panel was used 42-inch HD cell size. A ultra driving system (UDS) and photo-sensor amplifier (Hamamatsu, C6386) were used to measuring the address delay time and changed wall voltage. The panel temperature of the test panel varied from -5 to 65oC by controlling the temperature on the glass of the rear panel with an external cooler and heater.

The MgO single crystal powder (20 %) was deposited on the MgO layer by using the spray method. The gas chemistry in the experiment was Ne-Xe (11%)-He (35%) under a pressure of 420 Torr. The detailed specifications of the two panels were exactly the same, except for the MgO single crystal powder that was used.

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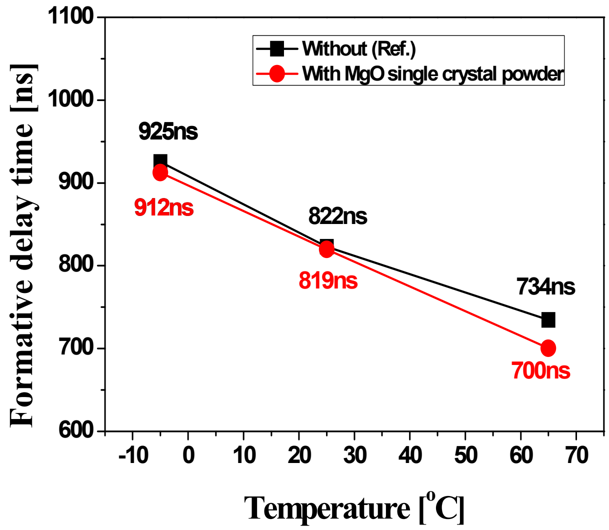
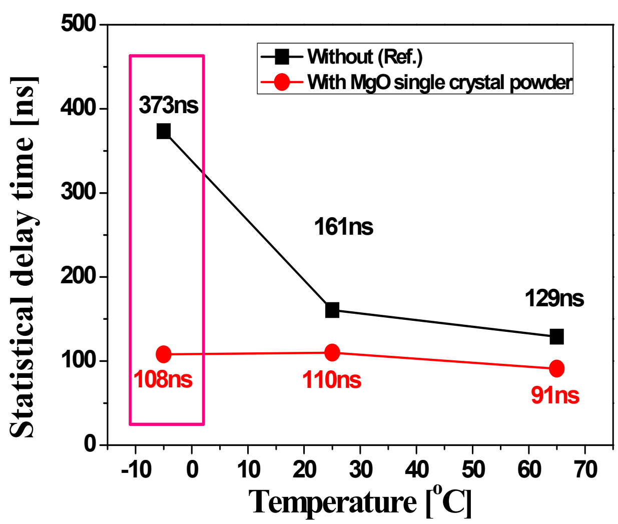


(a)



(b)

Figure 2. Variation of address discharge delay time relative to the panel temperature [(a) formative delay time and (b) statistical delay time]

3. Results and Discussion

Figs. 2 (a) and (b) show the variation of the formative (a) and statistical delay times (b) relative to the panel temperature. In both cases of MgO layer without and with MgO single crystal powder, the formative delay time was increased with a decrease in the panel temperature. In the case of MgO layer without MgO single crystal powder, the statistical delay time was increased with a decrease in the panel temperature. In particular, the statistical delay time was drastically increased at the low temperature (-5 ^{o}C), which was caused by the reduced thermal activation [3, 4].

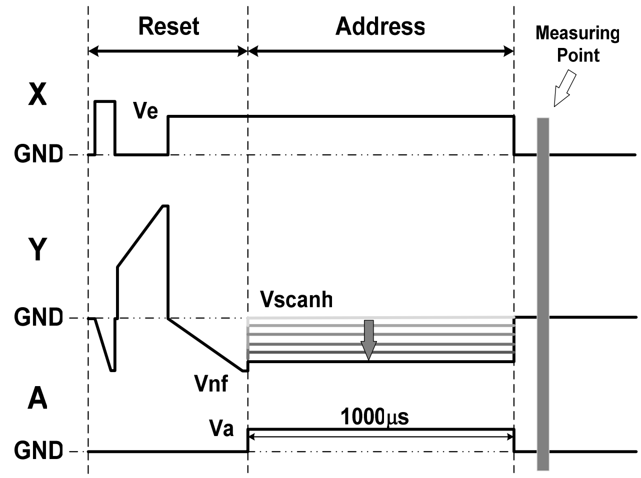


Figure 3. Driving waveform employed for measuring wall voltage during address-period.

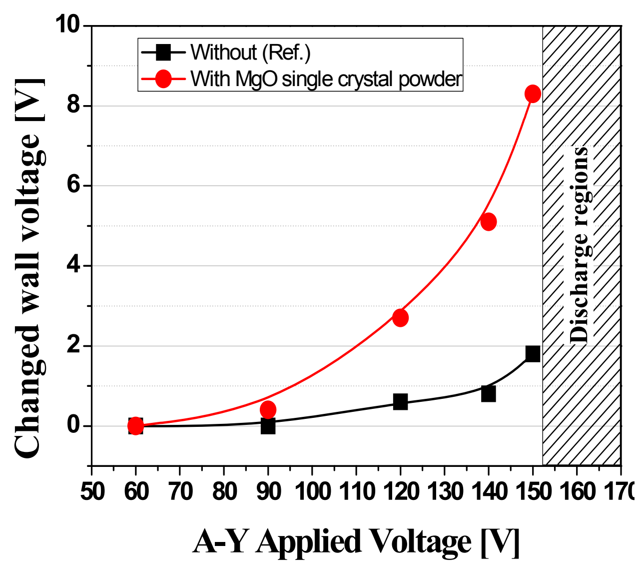


Figure 4. Changed in the wall voltage under low panel temperature relative to A-Y applied voltage (Va – Vscanh) during address period.

However, in the case of MgO layer with MgO single crystal powder, the statistical delay time was almost the same irrespective of the variations in the panel temperatures, meaning that for the MgO single crystal layer, the low temperature did not affect the statistical delay characteristic. In this case, it was obvious that the statistical delay characteristic of the MgO layer with MgO single crystal powder did not depend on the panel temperature, especially low panel temperature below – 5 0C, implying that for the

MgO single crystal layer, there would be another factor for improving the statistical delay characteristic except the panel temperature. The electric field intensity is thought to be a possible candidate.

Here, in relation to the statistical delay, the electron emission was not measured directly according to the electric field intensity. Based on the recharging process about the wall voltage variation during the address period [3. 4], the wall voltage variation instead of electron emission was measured according to the electric field intensity.

Fig. 3 shows the driving waveform employed to measure the electron emission characteristics of the MgO layer with and without MgO single crystal power according to the variation in the electric field intensity. In Fig. 3, the Vscanh voltage was varied from 0 to -90 V in order to investigate only the electron emission phenomenon without producing the address discharge. Other voltages during the address period were fixed as follows: X-bias voltage (Ve) was 110 V, Vnf was -150 V, and address voltage (Va) was 60 V.

Fig. 4 shows the changes in the wall voltage under low temperature when applying the driving waveform of Fig. 4. For the MgO layer without MgO single crystal powder, the wall voltage was slightly increased by about 1.8 V at an applied voltage of 150 V. On the other hand, for the MgO layer with MgO single crystal powder, the wall voltage was exponentially increased by about 8.3 V at an applied voltage of 150 V. This result indicates that the electron emission characteristics of the MgO layer with MgO single crystal powder strongly depend on the electric field intensity.

4. Conclusion

In this paper, to analyze the effects of the electric field intensity on the emission characteristics of the MgO layer with MgO single crystal powder, the variations in the wall voltage induced by the electron emissions were measured relative to the electric field intensity between the A-Y electrodes during address period. The measurement result confirms that the electron emission of the MgO layer with MgO single crystal powder strongly depends on the electric field intensity instead of the panel temperature.

5. References

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