Influence of constraint MgO deposition onto phosphors on luminance properties in AC Plasma Display Panels

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Abstract

One of the important problems in recent AC-PDP technology is the image sticking. In this research, we have investigated the PDP cell with constraint deposition MgO on phosphor, the electrical and optical properties in the PDP cell were examined. Also, we have investigated the correlation with image sticking and degraded MgO protective layer, phosphor in AC-PDP. As a result, we measured the secondary electron emission coefficient g, discharge characteristics and Brightness for the constraint degraded phosphor are compared with those of non-degraded phosphor.

1. Introduction

The ion-induced secondary electron emission coefficient γ is one of the characteristics of the MgO protective layer which correlates with the ignition voltage of AC-PDPs[2-3]. Recently many researchers have been studying to get the highest γ[4]. One of the serious problems in recent AC-PDP technology is the image sticking[5]. In this research, we have investigated the correlation with image sticking and degraded MgO protective layer, phosphor in AC-PDP. The MgO protective layer and phosphor are exposed to the discharge space. So we think that the MgO protective layer and phosphor are major factors of image sticking. And then throughout the experiment, we have found that degradation of phosphor and MgO protective layer has influence on the image sticking and the characteristics of discharge. In this research, As a result, we measured the secondary electron emission coefficient γ, discharge characteristics and Brightness for the constraint degraded phosphor are compared with those of non-degraded phosphor.

2. Experimental configuration

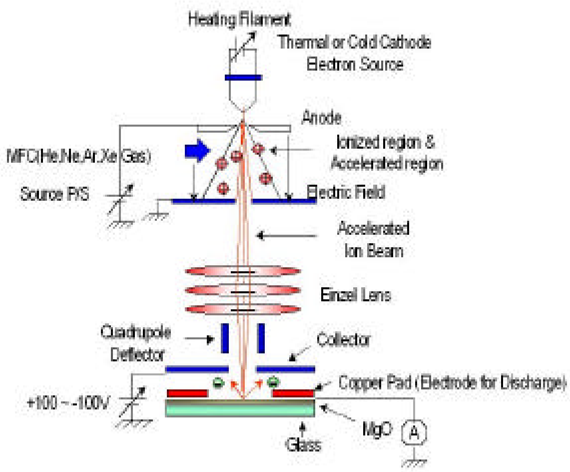


Figure 1. The schematic of γ-FIB system

Figure 1 shows the schematic γ-FIB system for a measurement of secondary electron emission characteristics from MgO protective layer and phosphor. The γ-FIB system is broken down into five basic components: the diode consisting of thermionic electron source and anode, electron-impact ion formation and its acceleration region, electrostatic single Einzel lens for ion beam focusing, quadrupole deflector, and substrate for γ measurement of MgO thin film, respectively. The background vacuum pressure of γ-FIB is maintained at 1.6×10^{-5} Torr, whereas it is kept by up 7×10^{-5} Torr during ion beam formation with gas feeding. The ions are produced by impact collisions of thermal electrons emitted from filament to the each of the neutral gases. The kinetic energy of ions is depended on the ion accelerating voltage applied to the anode. The anode positive biased and can be +50 up to +500V for the ion acceleration, and these ions are passed through the 0.5mm-diam. Beam-defining aperture along downstream of the system. The ion beam is the focused by single electrostatic Einzel lens and scanned by the quadrupole deflector onto the thin film surface with fixed beam diameter of 80 um throughout this experiment, which can be achieved by adjusting the filament heating current under the given ion acceleration energy. The test panel for this experiment is a 3.5 inch, VGA class AC-PDP with a cell pitch of 1080 µm.. Operating condition is square sustain pulse with 35 kHz, 25 % duty ratio in 400 Torr using the Ne–Xe (4%). The MgO protective layers are deposited on the phosphor by electron beam evaporation method. The thickness of MgO thin film is 50, 100, 250, and 500Å, respectively. The deposition rate is 5Å/s. In this experiment, Ne^+ ions are used for the measurement of γ by varying its energy from 80eV to 200eV for MgO protective layer on phosphor.

3. Experimental result

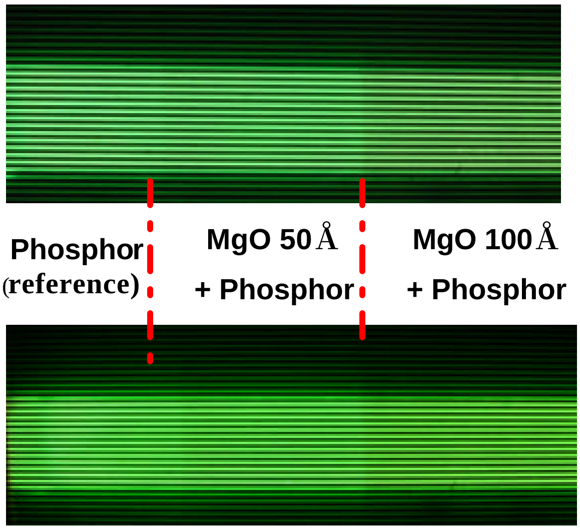
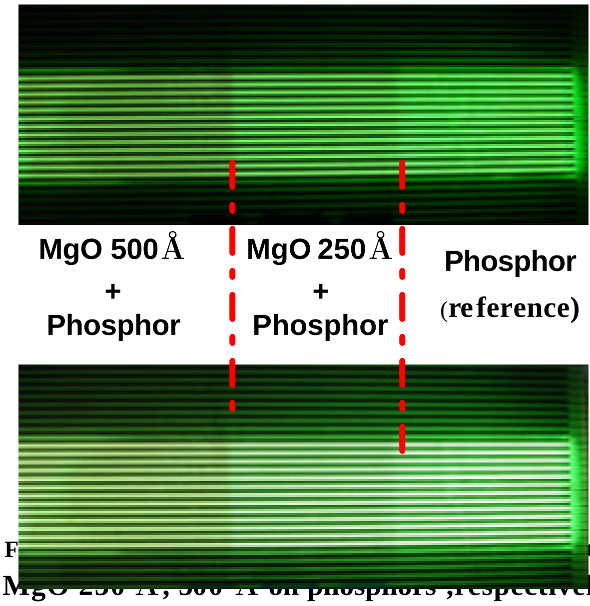


Figure 2. Image of PDP with constraint deposited MgO 50 Å, 100 Å on phosphors ,respectively. (Upper image of Ne-Xe(300torr) and lower image of Ne-Xe(400torr))

Figure 2, 3 shows a test panel discharging image in this experiment and normal(reference) cells, 50, 100, 250, and 500 Å deposited MgO on phosphors cells, respectively.



F ed MgO 250 Å, 500 Å on phosphors ,respectively. (Upper image of Ne-Xe(300torr) and lower image of Ne-Xe(400torr))

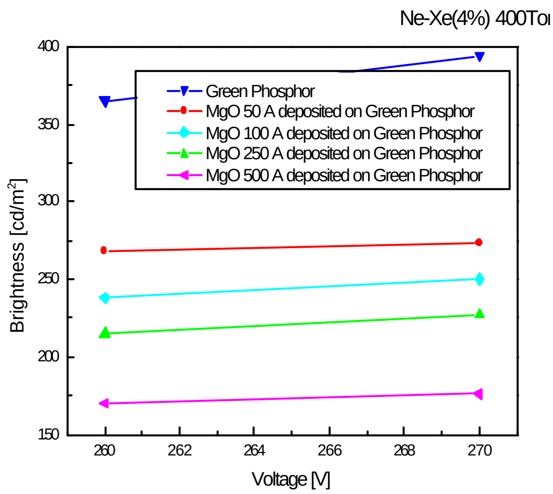


Figure 4. Brightness of PDP with variation constraint deposited rate MgO on phosphors

Figure 4 shows luminance as the test panel has been non, 50, 100, 250, and 500 Å deposited MgO on phosphor, respectively. The non-deposited MgO on phosphor has the highest luminance from 365 to 390 cd/m^2, while from 170 to 178 cd/m^2 for 500Å deposited MgO on phosphor processed part in voltage ranges from 260 to 270 V throughout this experiment.

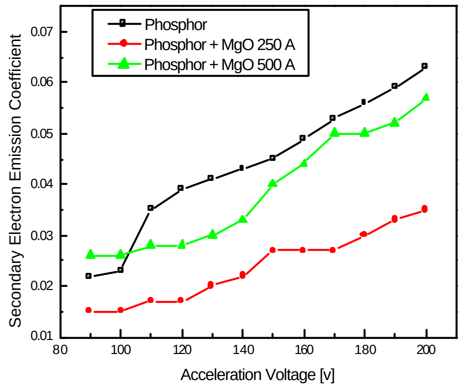


Fig 5. Secondary electron emission coefficient according to the phosphor has constraint degraded or not

Figure 5 shows secondary electron emission coefficient γ of the phosphor as the test panel has been 250 Å deposited MgO on phosphor, 500 Å deposited MgO on phosphor and non-deposited MgO phosphor. The non-deposited MgO on phosphor has the highest secondary electron emission coefficient γ from 0.02 to 0.06, while from 0.015 to 0.03 for 250 Å deposited MgO on phosphor processed part, from 0.025 to 0.056 for 500 Å deposited MgO on phosphor part in acceleration voltage ranges from 70 to 200 V throughout this experiment.

4. Conclusion

We have measured the ion-induced secondary electron emission coefficient γ and basic discharge characteristics of MgO protective layer and phosphor according to the constraint deposited MgO on phosphor for test-PDP. The secondary electron emission coefficient γ of non-deposited MgO on phosphor is higher than deposited MgO one. Reduction of luminance is due to increment of deposited MgO on phosphor. In consequence, luminance efficiency is reduced by deposition MgO on phosphor in comparison with non-deposited MgO on phosphor cell. Such a remarkable MgO protective layer due to degradation is thought to be one of main factors of image sticking

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5. Acknowledgements

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6. References

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