Influence of the degradation of MgO protective layer on the Surface profiles and discharge characteristics in AC-PDP.

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Abstract
The MgO protective layer provides protection from the discharge, lowers the discharge voltage and prolongs the AC-PDP lifetime. We have investigated the characteristics of degradation of MgO protective layer, which correlates to the image-sticking[1] and the lifetime in AC-PDP. The degraded MgO have been changed the surface morphology of MgO. It was found that panel lifetime depended on degradation of MgO protective.

1. Introduction
The characteristics of MgO protective layers are very important for the development of recent AC-type plasma display panel. The ion-induced secondary electron emission coefficient γ is one of the characteristics of the MgO protective layer which correlates to the ignition voltage of AC-PDPs and it also protects to sputter dielectric which correlate to the lifetime[2]. Accordingly, study of the degradation of MgO protective layer has been suggested as a key factor to govern the life-time of AC-PDP.

In this experiment, we have investigated the characteristics of degration of MgO protective layer as time passes. First of all, the panel structure of AC-PDPs with the cell pitch is set to be 1080 um. The sustaining electrode is located on the outer edge of transparent electrodes is made of silver paste and its width is held at 80 um. Also the sustaining electrodes that are covered with dielectric layers of 30 um in thickness are parallel to each other in front glass.

2. Experimental Setup
MgO thin films of a panel were prepared by using electron beam evaporation method from sintered materials which is for getting higher quality of it. The MgO protective layers are deposited on the front panel by the method and vacuum annealed under 200℃ about 20 minutes after the deposition. The thickness of MgO thin film is 5000Å. The deposition rate is 5Å/s And we were driving the panel in a condition of degradation for about 37 hours and observe of the MgO protective layer surface by the optical-microscope.

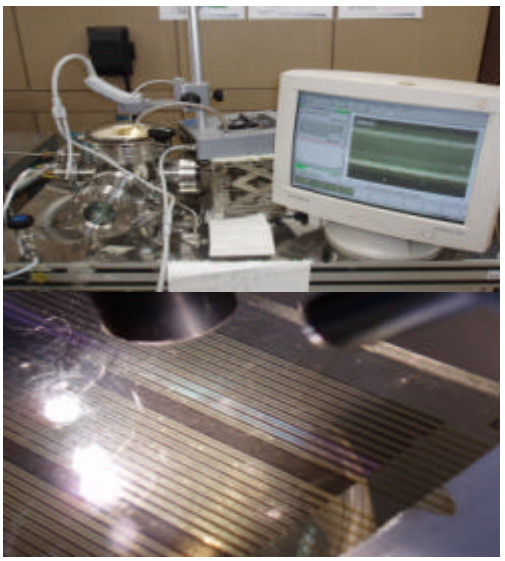

Fig. 1. PDP Chamber and Optical Microscope.

We have also investigated voltage margins according as time passes and difference of brightness between reference and degradation discharge area of the test panel. Before voltage margins were measured every 2 or 3 hours, the gases were refreshed for same gas conditions.

3. Experimental Results

Influence of degradation of MgO protective layer on the surface profile was observed by optical microscope as time passes. For observation of enough cell pitch, we use the lens of 200 magnifications.

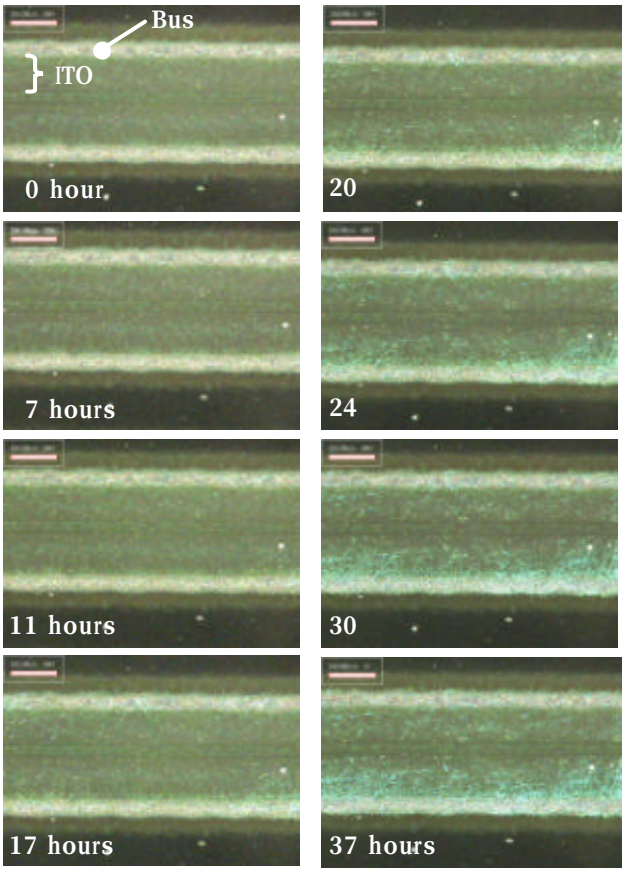

Fig. 2. Optical microscope Images of MgO protective layers for several different degradation times of 0, 7, 11, 17, 20, 24, 30, and 37 hours.

Fig. 2 shows the images of MgO protective layers as degradation time is elapsed to 0, 7, 11, 17, 20, 24, 30, and 37 hours, respectively.

There is no difference in its surface morphology from 0 hour to 17 hours. Degradation on the surface of MgO protective layer was initially observed around 20 hours and appeared near a bus electrode by optical microscope. More degradation, it was apparently observed around 30 hours. Then, the distribution of difference of surface by degradation was also appeared near a bus electrode.

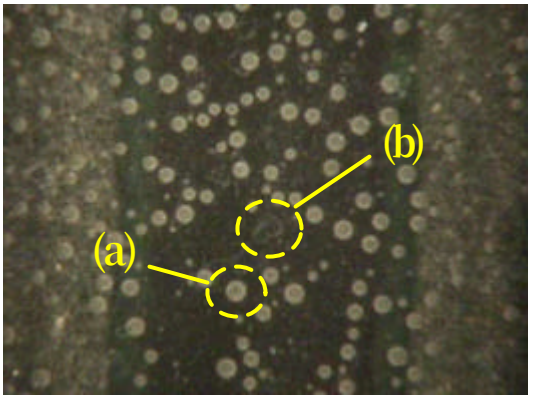

FIG. 3. Surface of MgO protective layer by degradation for 72 hours.

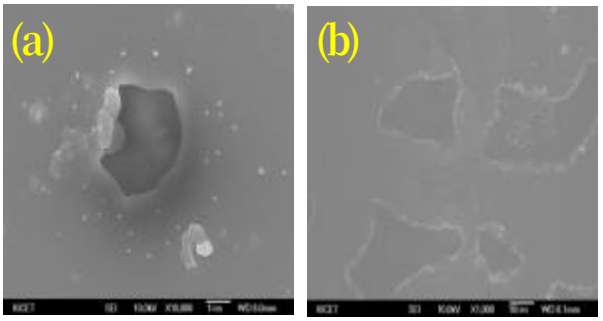

FIG. 4. SEM image for degraded MgO protective layer.

Additionally, more degradation makes detail images of the surface of MgO protective layer. Fig. 3 and Fig. 4 are the surfaces of MgO protective layer by degradation for 72 hours. Fig. 4 is SEM image of Fig.3 and according as degradation discharge time passes, there was a lot of MgO surface damages on the surface of MgO protective layer..

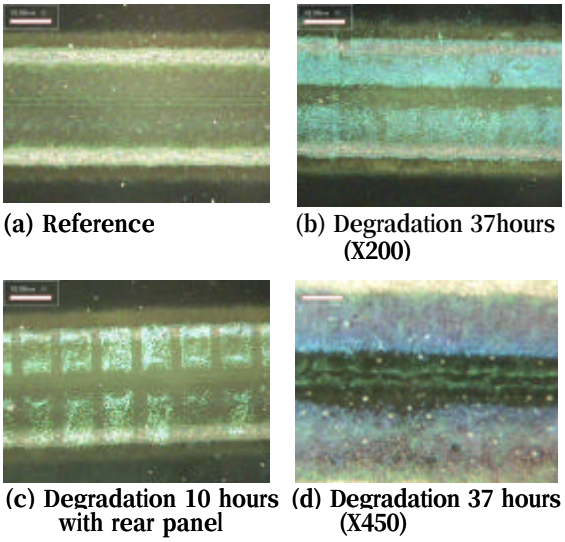

Fig. 5. Images of various kind of MgO protective layer by degradation.

Fig. 5 shows various kinds of images by degradation discharge. (a) is non-discharge area and (b), (d) are different area from the area of Fig. 2. (c) is a image of MgO protective layer employed rear panel with phosphor.

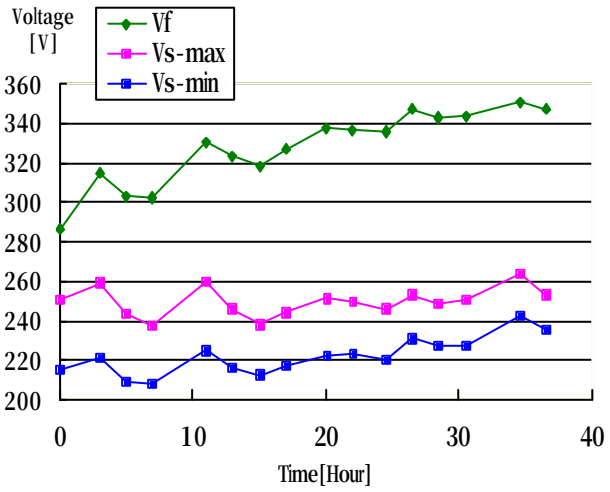

Fig. 6. Firing and sustain voltages by degradation.

Fig. 6 shows variances of the firing and sustain voltages by degradation discharge. According as time passes, firing voltage was entirely increased from 285V to 345V for 37 hours.

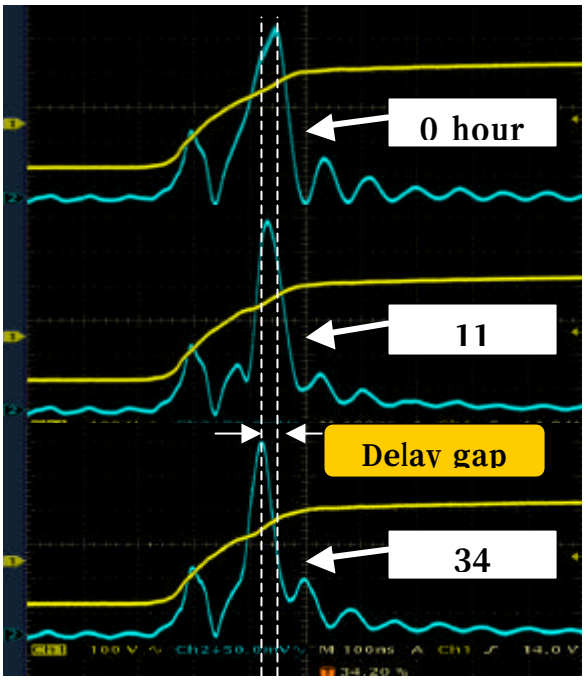

Fig. 7. Discharge current delay by degradation.

Fig. 7 shows the discharge current delay by degradation. It is noted that discharge current delay was same like a result for common panel with rear panel. During 34 hours, discharge current was shortened about 40n seconds totally.

We have made a comparison of brightness between reference and degradation area attached a rear panel after 37 hour degradation. The brightness of degradation area is about 45 cd/m^2 and the reference value is about 44 cd/m^2. Consequently, they are almost same values.

4. Conclusions

In this experiment, we have investigated the influence of degradation of MgO protective layer. First of all, surface of degradation was apparently seen around 30 hours on our experimental conditions and there was little different in brightness between reference and degradation of a test panel. Discharge current delay was shortened. However, unlike a common phenomenon which is dropping firing and sustain voltages at a front panel attached to rear panel[3], firing and sustain voltages entirely increased. It seems to be a hydration of MgO

protective layer which increased the ion-induced secondary electron emission coefficient γ in accordance with degradation discharge times.

Consequently, we find out the electrical discharge characteristics of a front panel with MgO protective layer in accordance with degradation discharge times, while the phosphor rear panel is not employed in this experiment.

5. References

[1] Kyu Bong, Jung "A Study of Electro-Optical Characteristic for Image Sticking and High Luminance Efficiency Penning Gas Mixture Ratio in AC Plasma Display Panel "(2004)

[2] H. S. Jeong, J. Y. Lim, W. B. Park, J. H. Choi and E. H. Choi," Measurement of for the degradation of MgO protective layer and Phosphor in AC-PDP", IDW'03(2003)

[3] Won Bae, Park " Study of correlation with degradation characteristics of MgO protective layer and plasma density and electron temperature as various discharge time in AC-PDP"(2004)