LGE's 60-inch AC Plasma Display Panel with 1365X768

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Abstract

LGE developed and demonstrated the first 60-inch full color AC plasma display panel with the 1365 X 768 resolution. Both Sol-gel and E-beam method have been tried for MgO layer, and photolithography has been used for electrodes and phosphor layer to fabricate a 60-inch panel. Selective Erase, Selective Write, Address Display Separate, and Address While Display driving scheme have been tested. Its luminance and contrast ratio is about 550 cd/m^2 and 500:1, respectively.

Introduction

Digital broadcasting is a revolution of TV technology in coming 2000 year[1]. Up to now, Plasma Display TV is the best candidate for the High Definition Digital TV screen in a large size(40 to 60-inch). Since 1996, LGE has invested lots of effort to develop AC Plasma Display Panels for the application of the digital TV screen. A 42-inch AC PDP with VGA resolution and 4:3 aspect ratio was developed in 1997. And a 50-inch XGA panel was also demonstrated at Korea Electronics show in 1998. It is believe that PDPs are most competitive display device in the range of 40 to 60 inch diagonal sizes. However, to achieve a 60-inch panel, several technical obstacles such as glass distortion, uniformity, etc, should be overcome. LGE developed the key technologies for the fabrication of the 60-inch PDP and succeeded in demonstrating a 60-inch PDP with XGA resolution at Korea Electronics show'98 and Asia Display'98. Now, I will present the LGE's project to develop the 60-inch XGA PDP as follows.

Panel Design and Fabrication

Figure 1 shows LGE's a 60 inch AC Plasma display Panel that is based on 3 electrode surface discharge mode. The panel specification is summarized in Table 1. The rear plate is 1374 mm X 824 mm and the front plate is 1404 mm X 794 mm. The cell pitch was designed as 0.978 mm X 0.978 mm. The width of the transparent electrode, ITO, is 300 μm and the discharge gap between two sustain electrodes is 60 μm. Asymmetry sub-pixel is employed to achieve color temperature of 8000 K°.

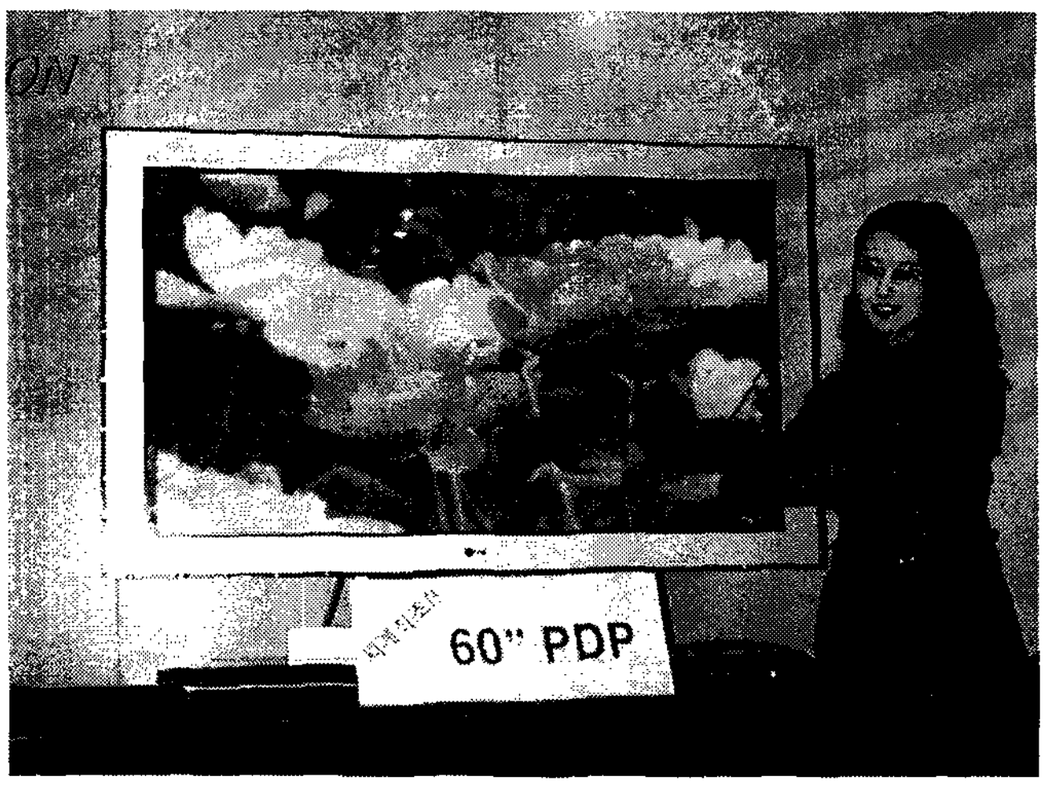

Fig. 1 LGE's 60-inch Plasma Display Panel with 1365X768 pixels

Items	Specifications
Screen Size	60 inch diagonal
Glass Size	
Rear plate	1374 mm X 824 mm
Front plate	1404 mm X 794 mm
Aspect ratio	16: 9
No. of pixels	1356 X 768
Cell Pitch	0.978 mm X 0.978 mm
Luminance	550 cd/m^2
Contrast Ratio	500:1 (Dark room)
No. of color	16.7 million
Viewing Angle	160 degree
Efficiency	> 1.0 lm/w
Life time	> 15,000 hour

Table 1 LGE's 60-inch PDP Specifications

Typical power consumption is 600 W. The weight and the thickness of the PDP module are 40 Kg and 80 mm, respectively.

The flow chart of panel fabrication is shown in Figure 2. For the fabrication of this panel, LGE used specially techniques. First, the separated exposing method by using single mask has been adopted because there is a technical problem to get a 60-inch photo mask. Figure 3 is a photo of the electrodes fabricated by using the separated exposing method. Second, a photolithographic process was introduced to fabricate phosphor layer and electrodes. The electrode formed by photolithography has ±5 μm width and ±1 μm thickness uniformity, respectively, and edge curl/undercut is below 1 μm. The phosphor layer was also fabricated by photolithography. Its thickness was 25~30 μm. The advantages of photolithography to coat phosphor on the large area panel were to avoid the mixing color between adjacent layers. The fabrication technique of the phosphor layer with a good uniformity had been obtained using a photolithography. Third, the barrier rib was made using Sand blasting technique. The height variation of the barrier rib was ±5 μm in a 60-inch panel. Fourth, the protecting layer, MgO, was coated using Sol-gel and E-beam method. The film quality of Sol-gel MgO was good as much as that of the e-beam coated MgO. Fifth, soda lime glass was pre-annealed before panel process. The glass distortion was improved by 63% and 50 % in the vertical and the horizontal direction, respectively.

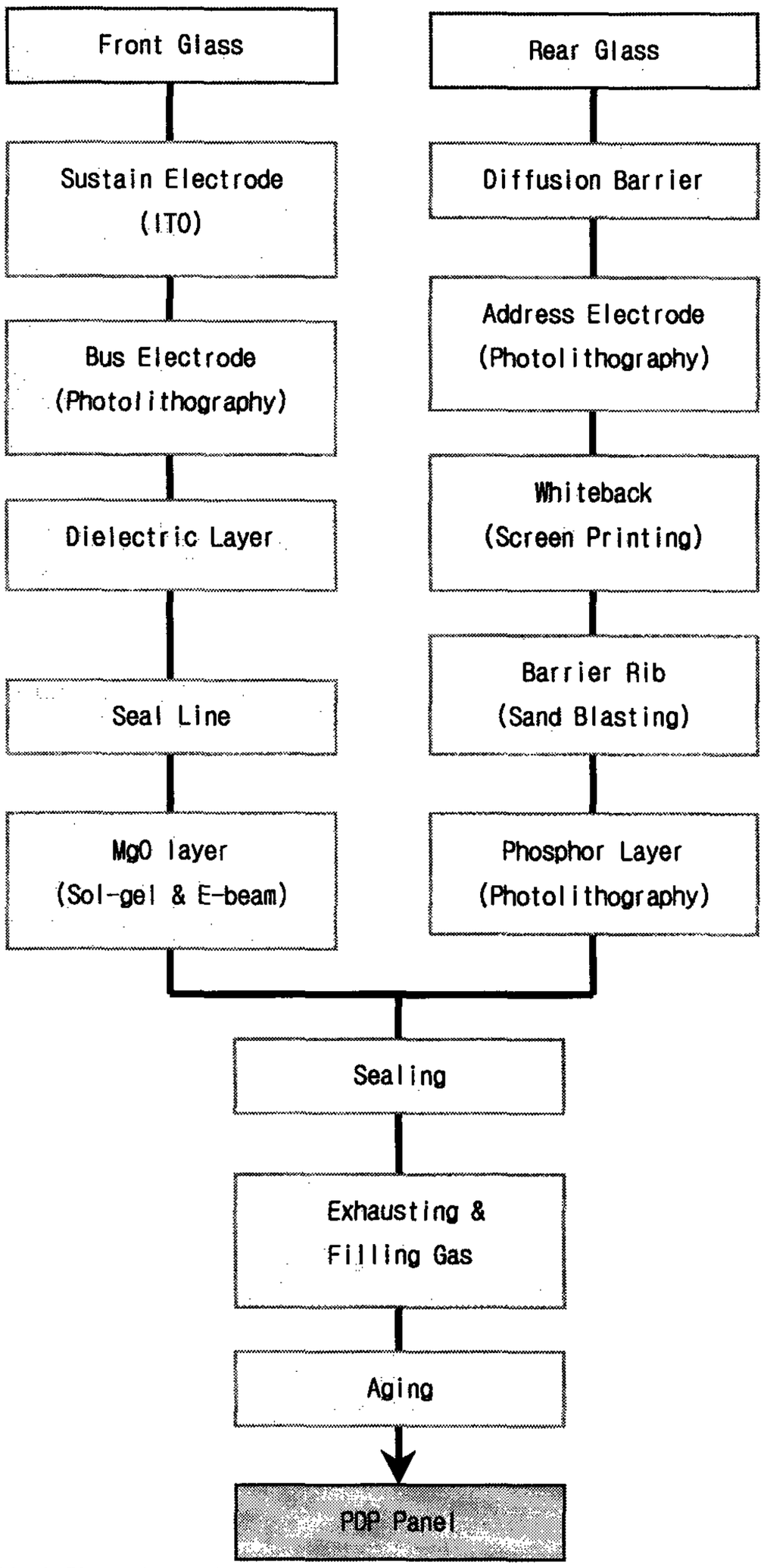

Fig.2 Flow chart of a 60 inch PDP fabrication

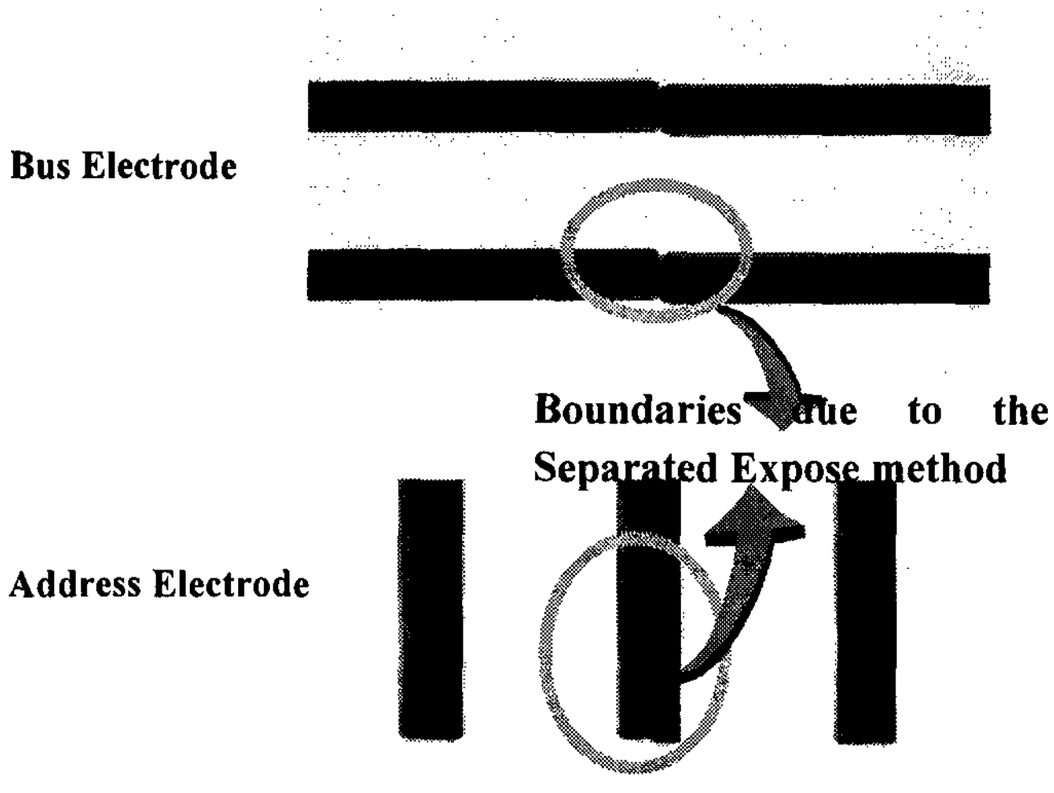

Fig.3 Electrodes formed by the separated expose method

Panel Driving

The penning mixtures, Helium, Neon, Xenon, and Argon have been used as the discharge gas in the pixel. The partial pressure of Xenon to Neon was below 5.5%. The good efficiency was observed at the gas discharge of 10~30% Helium under the pressure of 500 to 600 Torr. Figure 4 shows the color coordinator obtained from various gas mixture discharges.

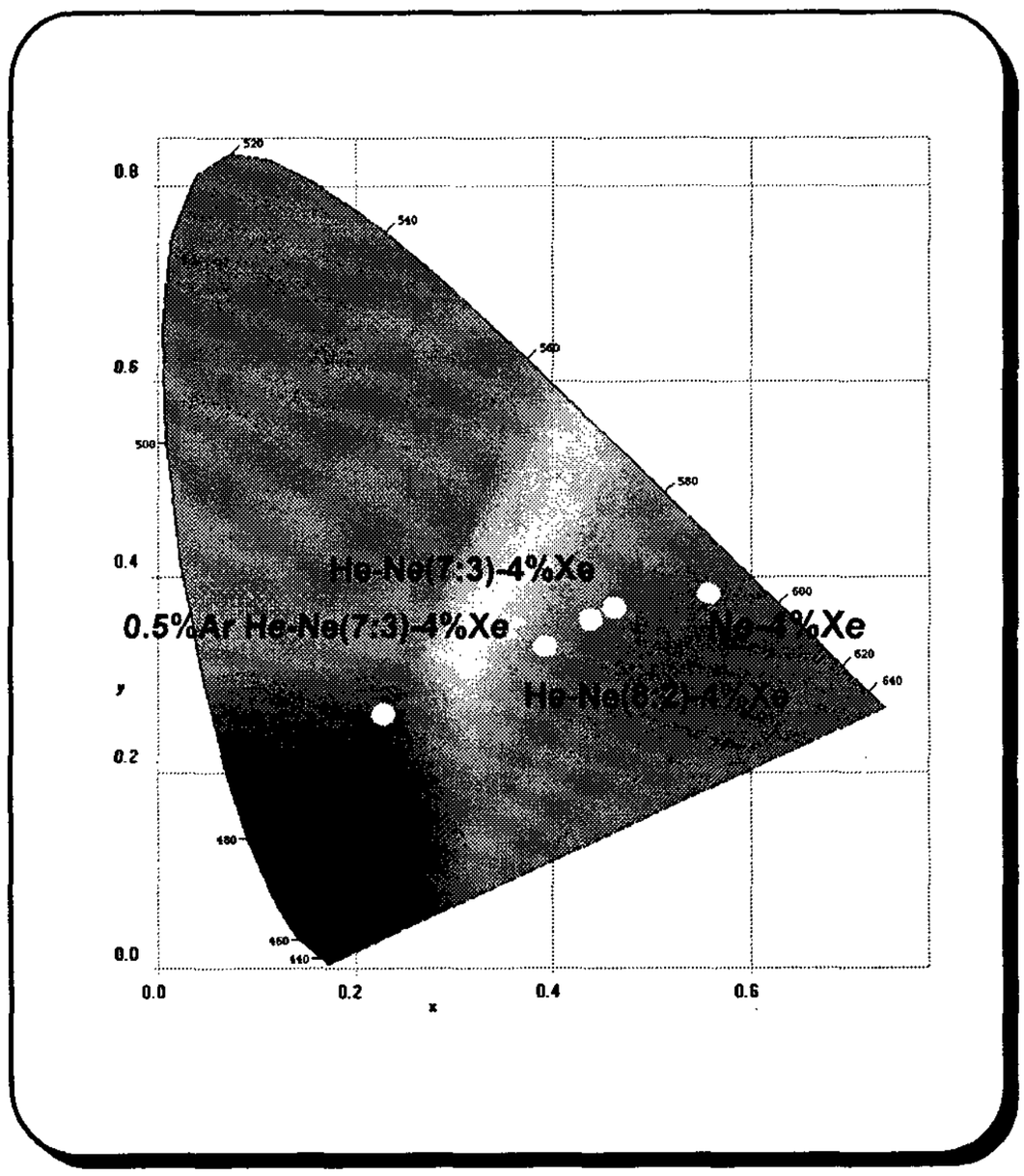

Fig. 4 CIE diagram from the various gas mixtures discharges

As the number of pixel increases, high speed addressing is required. LGE developed a high-speed address technique called LGSE (LG Selective Erase). This new driving scheme is a kind of AWD (Address While Display)[2] and has no reset period. Erase pulses are applied to data and scan lines, respectively, during sustain period. LGSE can use two or four addressing in one sustain period. As shown in Figure 5, this multiple addressing technique looks like letter V and W[3].

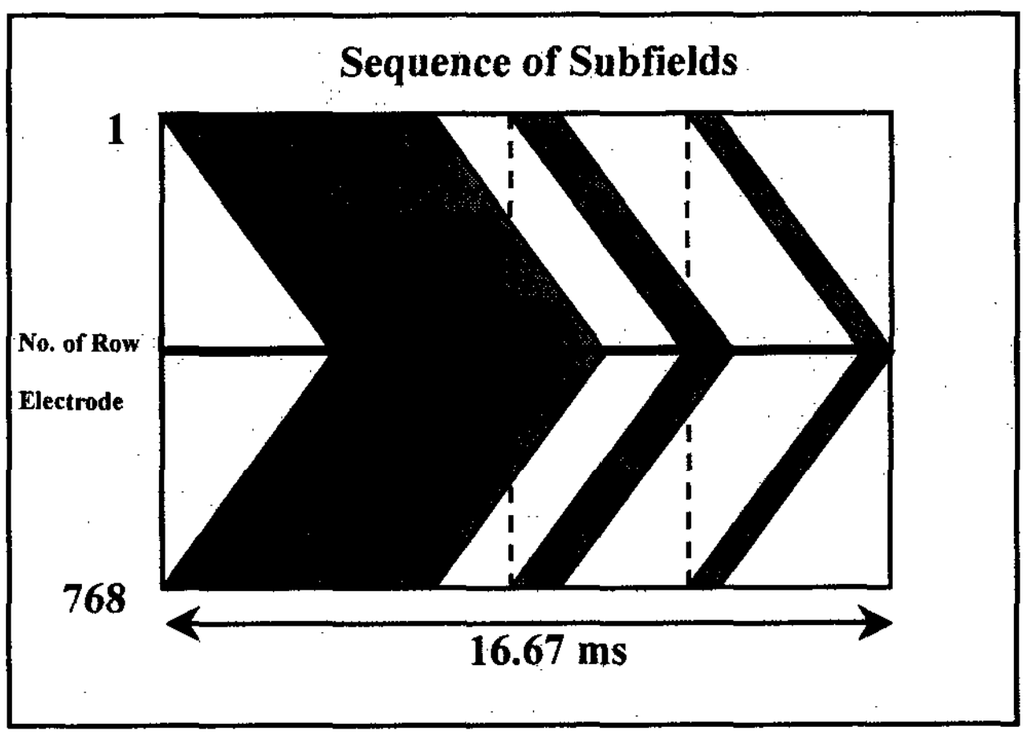

Fig. 5 V scanning for multiple erase-scanning to two picture segment

The single scan driving scheme is used in LGSE. Scanning starts from the top of the first picture segment and the bottom of the second picture segment and ends up meeting at the bottom of the first picture segment and the top of the second picture segment. LGSE uses half the number of drivers as ADS (Address Display Separate Method). While ADS operates with 100 V data driver voltage, LGSE can operate with 80 V data driver voltage and shows a good luminance at low frequency sustain pulses.

ADS was also employed to display color images in a 60-inch panel. The dual-scan driving scheme was tried too.

Summary

The fabrication and the driving scheme of LGE's 60-inch panel with 1365X768 lines have been presented in this work. Large area fabrication technologies with a good uniformity have been developed and the new driving scheme with a high speed addressing was demonstrated. LGE is still going to get a High Definition TV screen using Plasma Display Panel. Right now, the key technologies for achieving high efficiency, low cost, high-resolution plasma display panels are under development.

References

[1] M.Kurashige, *Proceedings of the 18th International Display Research Conference*, pp. 223-226, 1998.

[2] S.Mikoshiba, *Proceedings of the 18th International Display Research Conference*, pp. 191-194, 1998.

[3] Y.B.Song, J.H.Lee, M.S.Chung, B.Y.Park, M.H.Park, N.K.Lee, *Digest of Tech. Papers, SID '98*, pp. 628-631, 1998.