Characteristics of ac-PDP with hollow gaps between sustain electrodes

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The development of alternating current-plasma display panels(ac-PDPs) have been rapid due to their excellent performance as a large flat panel display, especially related to HDTV. While the image quality and performance of ac-PDPs are equal of superior to those of CRTs or projections, low luminous efficacy of ac-PDPs need to be improved. To solve these problems, the basic discharge phenomena, including working gases optimization, phosphor development, cell structure optimization, driving circuit optimization have been investigated.[1]-[2] Furthermore, another important problem for ac-PDPs is that they have high driving voltages. Generally, the characteristics of driving voltages depend strongly on the cell geometry. In the surface discharge type ac-PDPs, it is well known that an electric field is concentrated on the electrode edges.[3] Accordingly, we suggest two types of new front panel structure of ac-PDPs including hollow gaps between sustain electrodes. One has line shaped hollow gaps that we studied previously and the other has box shaped hollow gaps.[4] The new front panel structures can achieve low driving voltages and short discharge time lag due to the strong electric field in the hollow gaps.

Figure 1 shows the conventional structure of an ac-PDP and the proposed structure with hollow gap between sustain electrodes. The suggested structures are almost the same as a conventional ac-PDP. Figure 2 explains the difference between line shaped structure and box shaped structure. The experiment used 6 inches diagonal test panels with monochrome green phosphor under 450 Torr of gas pressure and various Xe contents. The width of sustain electrodes are 320 ㎛ and the distance between sustain electrodes are 140 ㎛ and 80 ㎛, respectively. The width of hollow gap is about 65 ㎛. The fabrication processes are similar to those of a conventional ac-PDP. The sustain voltage pulse with 30 kHz and 30 % duty ratio is applied across test panels. The luminous characteristics of the test panels are measured using a spectrometer and an oscilloscope. Figure 3 shows experimental results of discharge current characteristics for the conventional structure and suggested structures with hollow gaps. This experimental result explains that the box shaped structure reduced the current during discharge. Figure 4 shows the luminous efficacies for a conventional structure and suggested structures with hollow gaps. This experimental result confirmed that the dielectric structure with box shaped hollow gaps reduced the firing and sustain voltages by about 83.6 V and 45.2 V than a conventional structure at 10 % Xe content. Also, the proposed structure with 20 % Xe content improved the luminous efficacy by about 21.1 % when compare to a conventional structure with 10 % Xe content at the same sustain voltage. Whereas, the lower firing and sustain voltage in the proposed structures indicated a higher electric field in the hollow gap at the same voltages.

In summary, front panel structures of an ac-PDP including hollow gaps was proposed to achieve low driving voltage and high luminous efficacy based on the strong electric fields in the hollow gap. The suggested structures reduced firing and sustaining voltages by about 83.6 V and 45.2 V, respectively when compared with a conventional structure. In addition, an improvement of the luminance and luminous efficiency is also anticipated as a result of the strong electric field in the hollow gap.

Acknowledgement

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Reference

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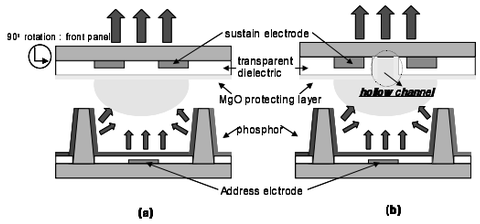

Fig 1. Schematic diagram of AC-PDP (a) a conventional structure and (b) suggested structure with hollow gaps between sustain electrodes.

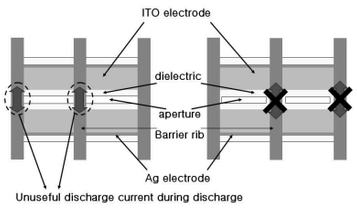

Fig 2. Schematics of proposed structure with line(left) and box shaped hollow gaps(right).

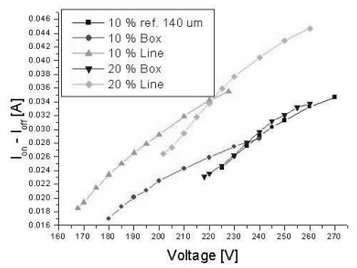

Fig 3. Variation of current for proposed structure with various Xe contents.

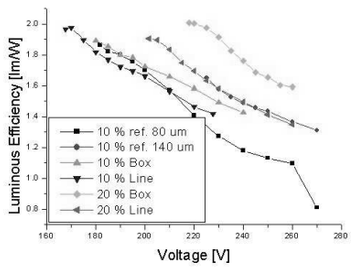

Fig 4. Variation of luminous efficacy for proposed structure with various Xe contents.