

The optical character analysis of the direct typed BLU for LCD TV

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Abstract

Recently, According to companies of TFT LCD are making large sized products more and more. In the vortex of Products with a monitor and LCD TV is applied in a technique of a high viewing angle(FFS, IPS, VA). Also, as a high luminance, high speed response time, high degree of a color purity, and so on are continuing to develop a high performance, it is necessary to improve a specific character of high luminance that apply to LCD TV as a LCD BLU. Because a LCD panel for TV usually has a lower resolution that compare to a monitor, the structure of present backlight system can't put out its power even though it has a merit in transmission. Therefore, the examination of improvement about the high luminance direct typed BLU for LCD TV that presupposes several uses of CCFL(Cold Cathode Fluorescent Lamp) or EEFL(External Electrode Fluorescent Lamp)is actively being progressed. Although it is necessary to increase the number of lamps for applying high performance by the direct type, in this case, because we can design the character of luminance for adoption of high performance. We can satisfy with a level of luminance for LCD

TV. Accordingly, we analyzed a change of the number of CCFL, mechanical and optical character to produce the direct typed backlight in 32inches spec. Consequently, we achieved luminance of 6597nit,which was including polarization film, and secured the standard for LCD TV.

1. Objective and Background

Demands of LCD market can divided into for application, Note PC, Monitor, TV in broadly speaking. Demands of monitors and note PCs gradually reach saturation state. Because of this tendency, finding out new consumers is examined progressively, and also, prices of making LCD are lowering at once. Particularly, existing markets which are based on pc expanded their markets into various applied fields of markets. As a result of this, they could create new customers and building widespread markets. As the effort to transfer LCD TV to TV using CRT is bigger and bigger, development of backlight that has a high luminance and low price is coming to the fore. In case of backlight for LCD TV above 20 inches, the type which is side light type and uses prism sheet is applied a lot. However, use of existing backlight system is a lot the price of prism sheet and it is difficult to luminance above 350nits in LCM(LCD

Module). So, Direct typed Backlight system has to examine thoroughly.

In this paper, we put in practice the simulation for the optimum of BLU in 32inches SPEC by changing each factor such as the number of CCFL lamps, the mechanical form and reflector, etc. In this simulation, we used a program for designing lighting that are SPEOS.

2. Simulation and Result

2-1 The evaluation of optical characters according to changing the number of lamps

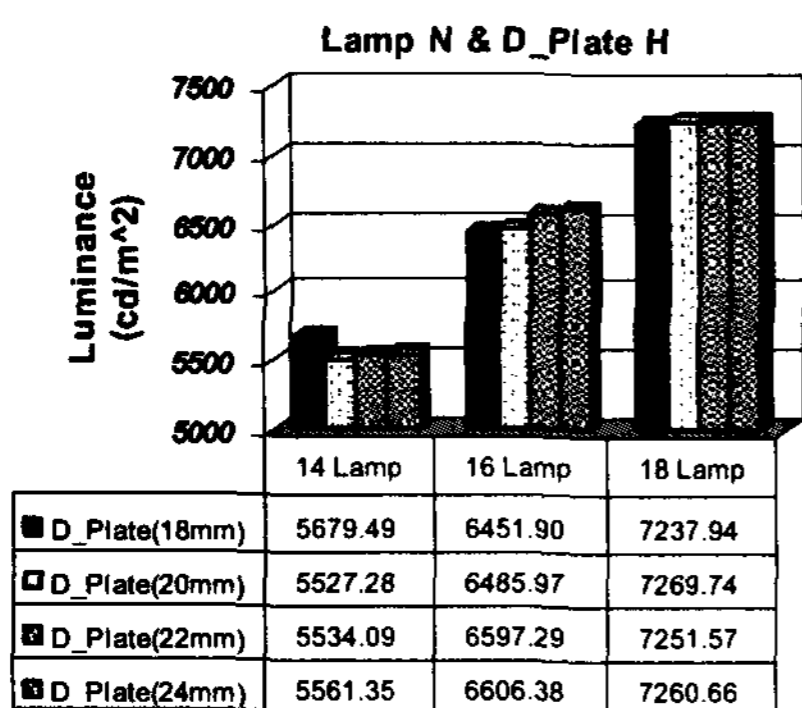


Table 1. The result according to changing the number of lamp.

We considered the white line, uniformity, and luminance which are the most important factors when a direct typed BLU is composed. Table1. show the number and a pitch of the lamp and then simulated. As a result, when a height of a diffuser-plate was maintained above 22mm from the bottom of BLU using same interval and 16lamps, we could compose the BLU in the best condition.

2-2 The evaluation according to changing the number of lamp and height of diffuser plate.

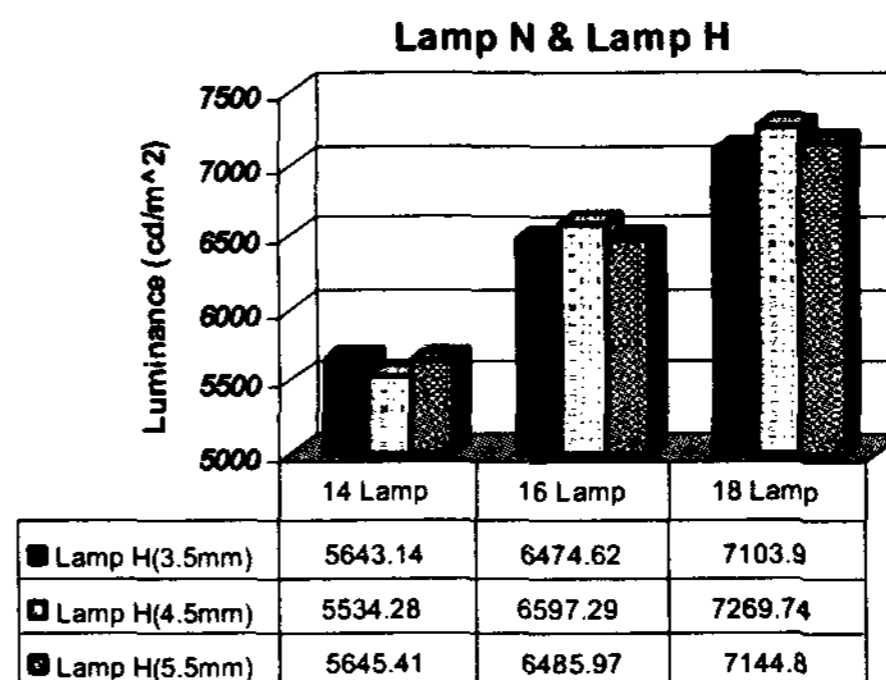


Table2. The result according to changing the number of lamp and height of diffuser plate.

Table2. show the height of the lamp from the bottom in a reflector didn't affect the luminance nearly. And we confirmed to secure removal of white line and uniformity only after we fixated the height of the lamp to 4.5mm

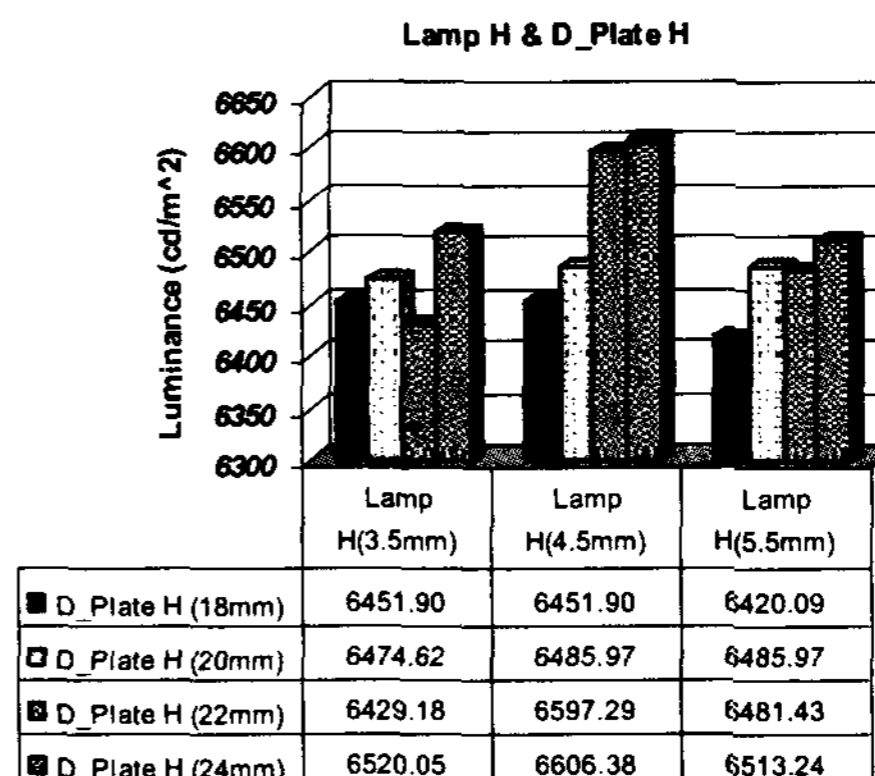
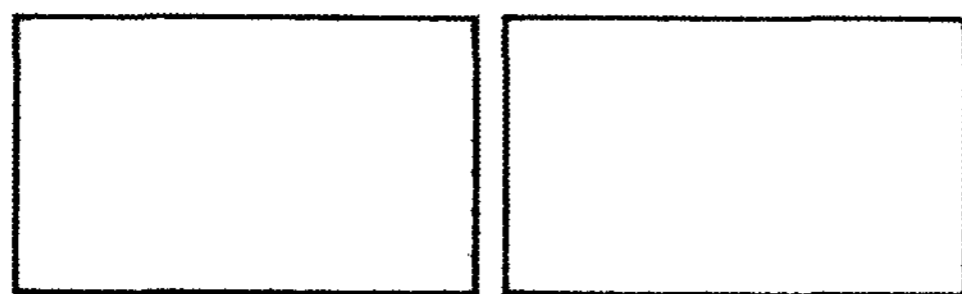


Table3. The result according to changing the lamp height and height of diffuser plate.

Table3. show that diffuser plate is optimized that difference of height between a diffuser-plate and lamps is above 16.5~17.5mm

Fig1. show that fig1. a) show white line because width narrowed between lamp and diffuser plate height



a) H = 13.5mm b) H= 16.5mm

Fig1. The result according to changing height of diffuser plate

2-3 The evaluation according to changing mold frame

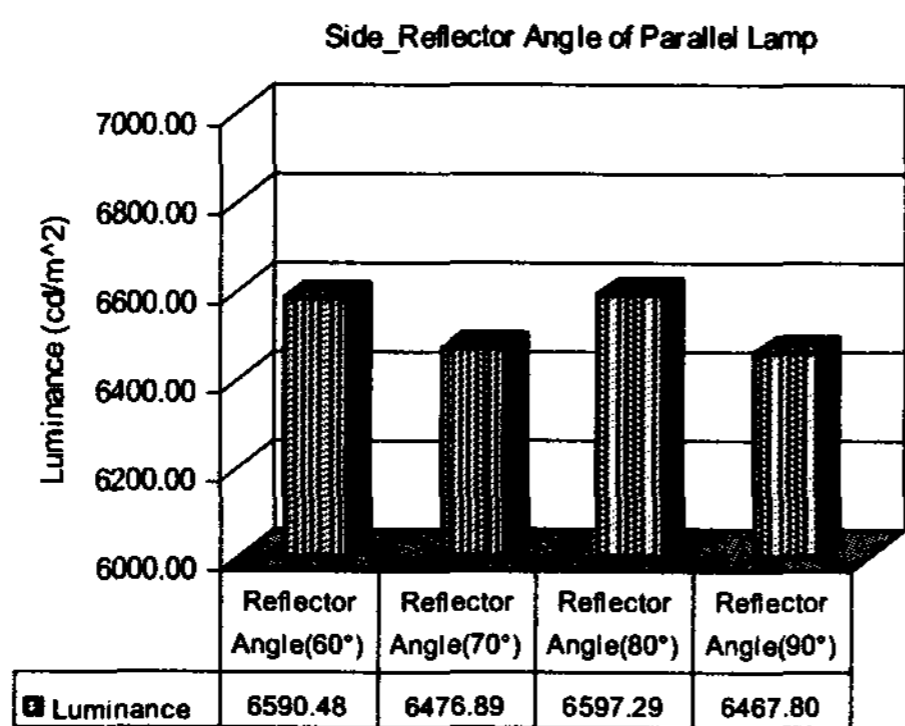


Table4. The result according to changing the form of reflector edge angle.

We wanted to raise uniformity. So, we measured the uniformity after changing the tip of lamp in direct typed backlight and the form of mold frame from 50 to 90 degree. So, Table4. show that uniformity was increased from 50 to 70 degree rapidly but which was similar above 70 degree. Also, the central luminance can be lowered as uniformity is raised too much. However, to raise central luminance of BLU by prism sheet, we decided the optimistic angle of mold frame to be 80 degree.

2-4 The result according to changing the form of reflector

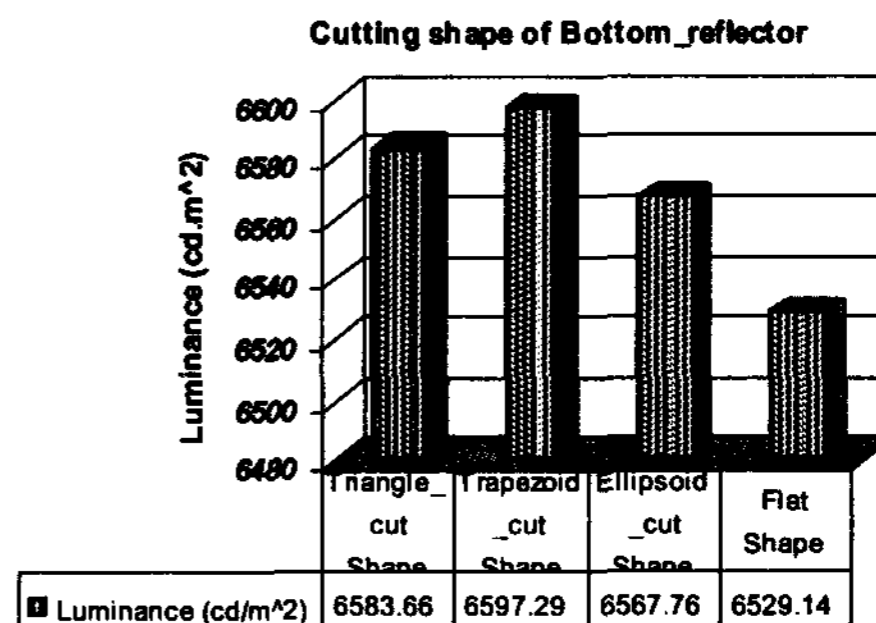
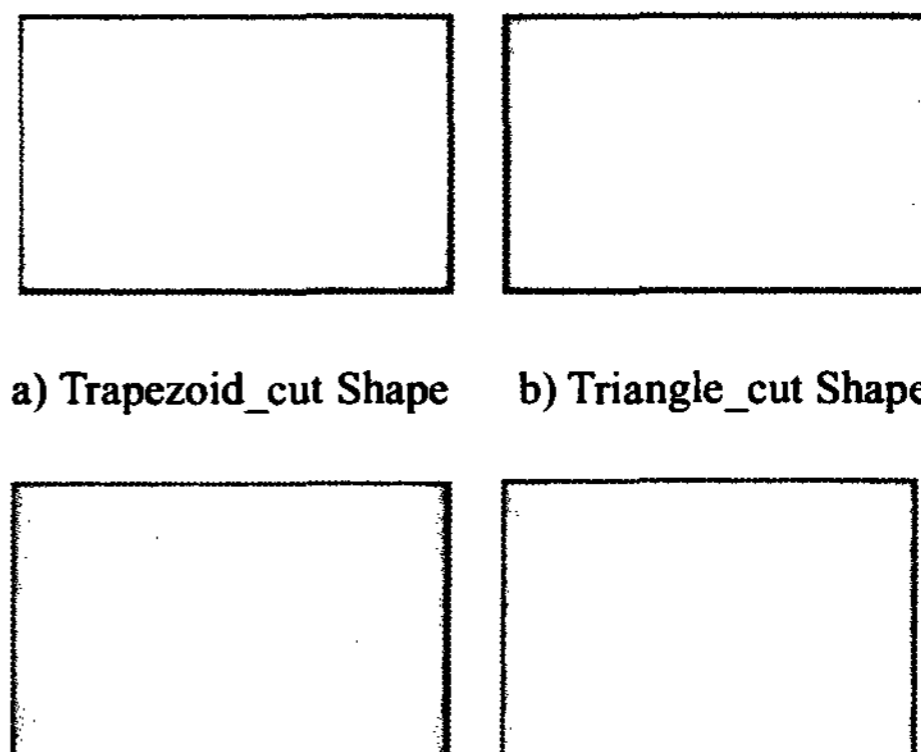


Table5. The result according to changing mold frame



c)Ellipsoid_cut Shape d) Flat Shape

Fig2. The result according to changing mold frame

In case of the reflector, in a direct typed backlight, we can largely consider two forms. First one is the structure that doesn't have the form of prism and the other is the reflector which has the form of prism. Table5. show that simulated as changing a prism angle, pitch, height and so on. In case the height 4.5mm, angle 80°, and pitch 26mm, it was an optimistic uniformity(Min70%, in 13 points) and luminance. And in case of reflector which is flat board, they showed us declining 1% in the luminance comparison to the thing which has prism.

3. Summary

In this paper, we developed direct typed backlight for LCD TV in 32inches SPEC. And as a result of simulation, we could get the luminance of 6597 nits from BLU which is composed of a reflector, diffuser-plate, prism sheet, and DBEF(polarization film). Also, after we designed with an optimistic concession for development of direct typed backlight. Then, consequently, when an angle of mold frame which is close to the end point of the lamp is 80 degree, it has a best condition. Also, when the height between the lamp and diffuser-plate is above 16.5-17.5 mm, we couldn't see white line. And in case of pitch, between lamps, there was no white line in an interval of 26 mm which included 16 lamps. Besides, in case of the reflector, when it has the form of prism, uniformity and a removal of white line was better than when it doesn't have. And we could apply for the special use which demanded TV as well as the high luminance as we used direct typed backlight. After this, in case of backlight, we found the possibility that we could correspond by changing conditions according to spec. that is asked for in the LCD module state.

4. Reference

- [1] A. R. Kmertz, "Current display trends from a historical perspective", Proceeding of IDW02, p.389, 2002
- [2] H. Noguchi, "A High-Efficiency ColdCathode Fluorescent Lamp for a Backlight Unit", SID 98 DIGEST p.243

- [3] H. Sasaki, "A Novel Backlighting Unit with Ultra-High Luminance for Monitor Applications", SID 99 DIGEST p.768