고연색 CCFL을 이용한 TFT-LCD 색재현율의 향상

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The Improvement of color reproduction ratio used to CCFL with high color rendering characteristic in TFT-LCD

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Abstract : At present, characteristic of high color reproduction for LCD TV is needed in Display market according to start mass production of LCD TV. Therefore development target for LCD is focused on improvement of color reproduction. The improving methods of high color reproduction are alteration of color Filter or Red, Green, Blue phosphor alteration of CCFL. But decrease of luminance and panel transmittance is caused by alteration of Color Filter. Accordingly, we completed LCD with high color reproduction by the most suitable emission spectrum of CCFL phosphor at panel with conventional color filter. In this experiment, we knew that LCD applied to CCFL with high color rendering characteristic had color reproduction range of 81% compared with NTSC in CIE color coordinate. According to increase of intensity peak and alteration of Red, Green, Blue phosphor spectrum, we made LCD with high color reproduction characteristic. In conclusion we achieved improvement of color reproduction ratio by alteration of CCFL phosphor without changing color filter.

Key Words : BLU, color reproduction, CCFL, LCD

1. 서 론

Recently, LCD TV market is needed to improvement of color reproduction ratio. So LCD TV product with high quality characteristic is developed by fast driving method without image sticking and high contrast ratio, wide view technology. So major development project is improvement of color reproduction characteristic as CRT level. Generally, according to expansion of LCD market, high color reproduction characteristic of LCD is needed for using by conventional Monitor. Color reproduction ratio of LCD has 70% by compared with CRT at present. But, improvement of color reproduction is needed for using of TV. It is an important factor for improvement of display quality. Normally, method for improvement of color reproduction ratio is realized by changing of Color filter. But decrease of luminance and limitation of color reproduction are caused by this method. But we developed new LCD with high reproduction ratio by tunning of R, G, B phosphor in CCFL without changing of color filter. At result, we completed by new CCFL with most suitable spectrum for improvement of color reproduction basic on research of CCFL with conventional emission spectrum at this experiment.

2. 실 험

We developed CCFL with high color rendering characteristic based on emission spectrum data of conventional CCFL. Picture 1 is measurement method of emission spectrum data.

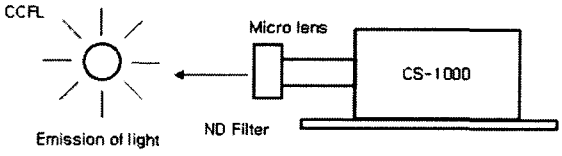


그림 1. Spectrum measurement (CS-1000)

Main peak of Blue is 430nm in conventional CCFL and Green has 560nm of main emission wavelength. And Red has 600nm of main emission peak and 680nm of sub emission peak. We made new high color rendering CCFL by shift of main peak of blue, red and green in conventional CCFL with emission spectrum for improvement of color reproduction. According to shift of main emission spectrum, increase of color gamet is accomplished. We used to improved Red, Green, Blue phosphor for making CCFL with this shifted spectrum. And we developed new CCFL considering to color filter with spectral

transmittance for application of improved CCFL. Picture 2 is conventional CCFL and high color rendering CCFL with measurement result of emission spectrum.

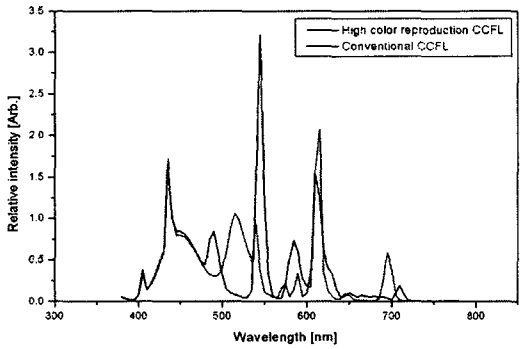


그림 2. Spectrum graph of CCFL

Picture 3 is spectral transmittance graph of color filter in panel.

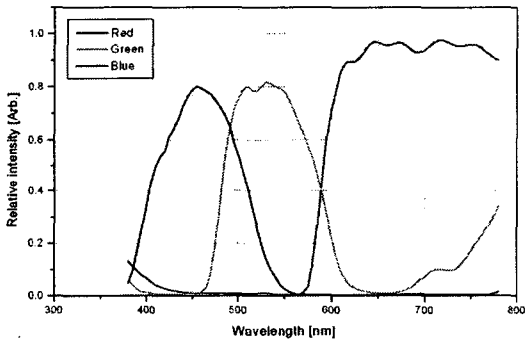


그림 3. Spectrum graph of Color file

Intensity of green phosphor is decreased according to shift 560nm of main peak from 540nm based on spectral transmittance of color filter. Because Main peak 550nm of green spectrum is most sensitive peak in visible sensitivity, decease of luminance is caused by shift of green spectrum.

Therefore, we considered the method with the maximum intensity and avoid main emission peak of conventional green phosphor. But according to using new green phosphor with shifted spectrum of main emission peak, decrease of intensity is unavoidable for increase of color reproduction ratio. We used by increase of CCFL operating current in compensation for decrease of intensity.

Accordingly it is possible in compensation for luminance. For next we measured transmittance of Red, Green, Blue spectrum in color filter of LCD.

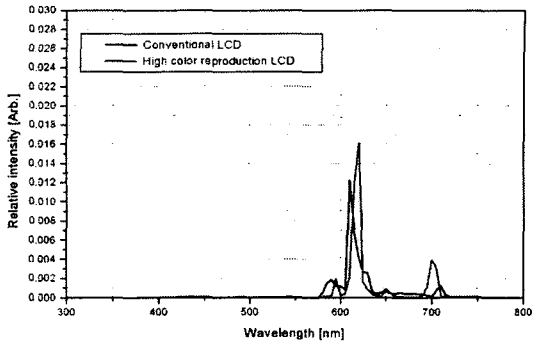


그림 4. RED spectrum in LCD Module

We know that red peak of high color reproduction LCD is shifted to the right.

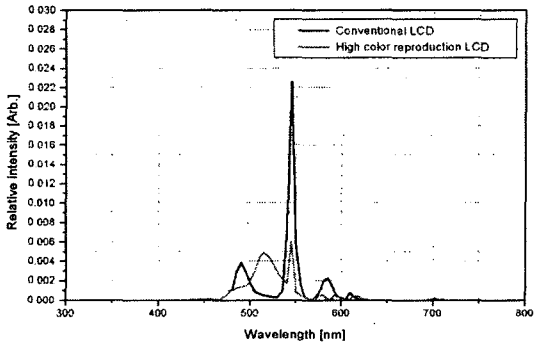


그림 5. Green spectrum in LCD Module

As we see the green spectrum, main green peak is shifted to left for increase of color rendering. According to shift of green peak, decrease of luminance is occurred by avoid of visible wavelength. It is weak point of high color rendering CCFL. We overcame the problem by using of more increased current than conventional CCFL with current 6.5mA.

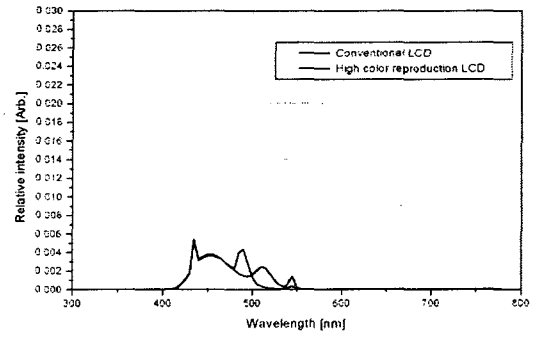


그림 6. Blue spectrum in LCD Module

Lastly main peak of blue is shifted to left for increase of color reproduction ratio.

As a result, we improved color reproduction characteristic by left shift of green, right shift of red peak. But according to improvement of color rendering ratio, luminance decrease of CCFL is occurred. So we used to increasing operating current in compensation for decrease of luminance. But according to increase of CCFL current, life time of CCFL is decreased.

It is critical fault in LCD product. For this problem, we replaced Ni electrode of conventional CCFL with Nb/Ni Clad electrode of long life time characteristic. The Nb/Ni Clad electrode has superior characteristic of heat emission and excellent electric characteristic of lower work function. We solved problem of life time by changing Nb/Ni clad electrode for conventional Ni electrode.

3. 결 과 및 검토

Picture 7 is method for color gamet measurement of LCD applied to high color rendering CCFL and conventional CCFL.

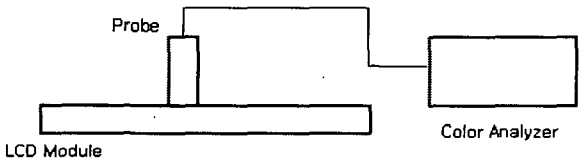


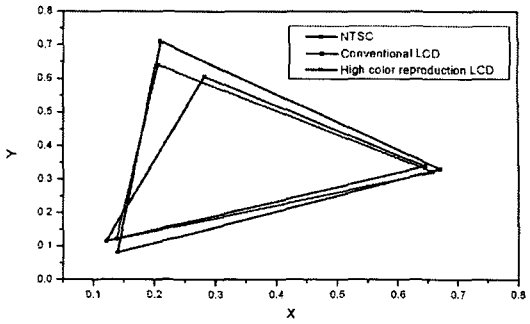
그림 7. Minolta CA-110(Color Analyzer)

According to changing of Red, green, blue display screen, color reproduction characteristic of LCD panel is measured by color analyzer. The measurement result is displayed on CIE chromaticity as picture 8.

4. 결 론

As seeing to the result, we knew that color rendering ratio of new CCFL is increased to up 11% by compared with color reproduction capacity of normal CCFL. But according to increase of color reproduction ratio, decease of luminance is occurred by intensity decrease of green phosphor.

For solving to problem of luminance decrease, we used to more increased current than operating current of conventional CCFL. But according to



	NTSC	Conventional LCD	High color reproduction LCD
Color gamut	100 %	70 %	81%

그림 8. Color reproduction ratio(at CIE chromaticity)

additional decrease problem of life time, we replaced Ni electrode of conventional CCFL with Nb/Ni Clad electrode of long life time characteristic. Eventually we improved color reproduction ratio of 11% than conventional LCD without changing of color filter by LCD applied to CCFL with improvement phosphor of red, green, blue.

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