BGR mixture phosphor for white-light-emitting diode of liquid crystal display backlight

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Abstract

BGR mixture phosphor pumped by 400 nm is developed for white-light-emitting diode of liquid crystal display backlight. White-emitting phosphor is prepared by mixing $Ba_2SiO_4:Eu^{2+}$ and $(Ba, Sr)_3MgSi_2O_8:Eu^{2+}$, Mn^{2+} phosphors.

1. Introduction

One potential candidate for the backlight for liquid crystal display is a phosphor-conversion white-light-emitting diode (white LED). Most white LED s are composed of blue-GaN LED chips and yellow Ce-doped yttrium aluminum garnet phosphor (YAG:Ce^{3+}) [1]. Many alternatives of YAG:Ce^{3+} phosphors haves been suggested: Eu^{2+}-doped alkali earth silicate phosphors [2, 3]. However, they offer still a low quality of color reproduction because of the lack of green and red colors in comparison with a conventional cold cathode fluorescent lamp. Here, we try to enhance the color reproduction characteristics of white LED by using a mixture of Ba_2SiO_4: $0.03Eu^{2+}$ and $Ba_{1.5}Sr_{1.5}MgSi_2O_8$:$0.01Eu^{2+}$, $0.06Mn^{2+}$ phosphors.

2. Experimental

Ba_2SiO_4: $0.03Eu^{2+}$ as a green-enhancing phosphor and $Ba_{1.5}Sr_{1.5}MgSi_2O_8$:$0.01Eu^{2+}$, $0.06Mn^{2+}$, as a blue and red enhancing phosphor are synthesized through a conventional solid-state reaction at 1250 °C for 4 hours in under a reducing ambient (5% of H_2/N_2). Emission spectra were obtained using PR-650 SpectraScan spectroradiometer.

3. Results and discussion

Emission spectrum of a mixture phosphor excited by 400 nm InGaN LED is shown in Fig. 1. The violet emission is from 400 nm InGaN LED as an excitation source. The blue emission at 460 nm is from Eu^{2+} ions in $Ba_{1.5}Sr_{1.5}MgSi_2O_8$:$0.01Eu^{2+}$, $0.06Mn^{2+}$ phosphor The green peak from 500 to 560 nm results from the overlap of two emission peaks of Eu^{2+} ions in Ba_2SiO_4:$0.03Eu^{2+}$ and $Ba_{1.5}Sr_{1.5}MgSi_2O_8$:$0.01Eu^{2+}$, $0.06Mn^{2+}$ phosphors. The red peak at 650 nm comes from Mn^{2+} ions in $Ba_{1.5}Sr_{1.5}MgSi_2O_8$:$0.01Eu^{2+}$, $0.06Mn^{2+}$ phosphor. The color reproduction index of our white LED is excellent in comparison with a conventional cold cathode fluorescent lamp.

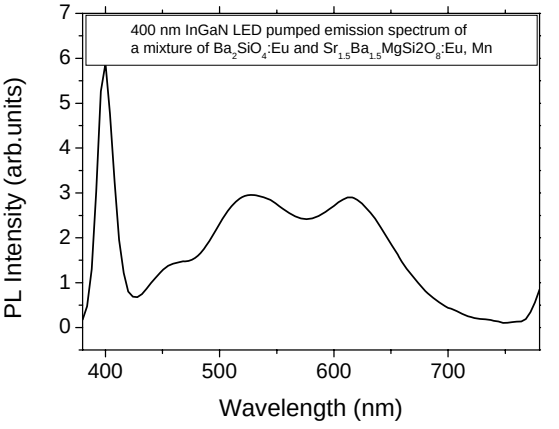

Fig.1. Emission spectrum of BGR phosphors excited by 400 nm InGaN LED.

4. Summary

Green Ba_2SiO_4: $0.03Eu^{2+}$ and blue-yellow-red $Ba_{1.5}Sr_{1.5}MgSi_2O_8$:$0.01Eu^{2+}$, $0.06Mn^{2+}$ phosphors are synthesized. A mixture of two phosphors can be applied for the down-conversion phosphor for white LED, and can give a high quality of LCD color reproduction in comparison with in comparison with a conventional cold cathode fluorescent lamp.

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5. References

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