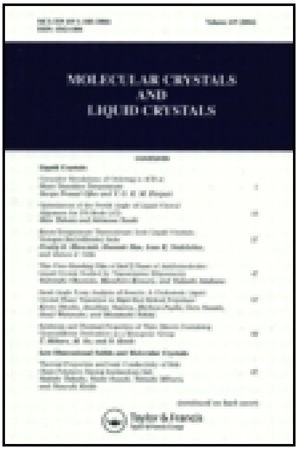

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Comparison of Electroluminescent Characteristics of $Zn(BTZ)_2$ and $Zn(BOX)_2$ Films Prepared by Vacuum Evaporation Method

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Comparison of Electroluminescent Characteristics of $Zn(BTZ)_2$ and $Zn(BOX)_2$ Films Prepared by Vacuum Evaporation Method

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Chelate-metal complexes such as zinc bis(2-(2-hydroxyphenyl)benzoxazolate) ($Zn(BOX)_2$) and zinc bis(2-(2-hydroxyphenyl)benzothiazolate) ($Zn(BTZ)_2$) have been known to show white luminance. In this study, the electroluminescent characteristics of $Zn(BOX)_2$ and $Zn(BTZ)_2$ was investigated using organic electroluminescent devices with the structure of ITO/TPD/Zn complexes/Al. It was found that $Zn(BOX)_2$ and $Zn(BTZ)_2$ show the blue-ish-white emission and the greenish-white emission, respectively.

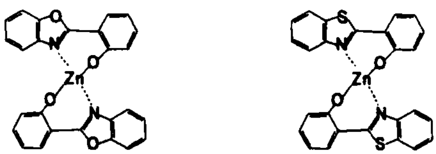
Keywords: electroluminescence; photoluminescence; chelate-metal complexes; luminous efficiency

INTRODUCTION

There has been an increasing interest in light emitting devices based on organic material[1]. A wide range of possible applications, including flat panel displays motivates such interesting. The features required of organic EL device are low drive voltage, high luminance and high luminous efficiency. The main applications for organic EL devices are full color flat displays and also back-light for liquid crystal displays[2]. In this study, we investigated some chelate-metal complexes such as bis(2-(2-hydroxyphenyl)benzoxazolate) ($Zn(BOX)_2$) and zinc bis(2-(2-hydroxyphenyl)benzothiazolate) ($Zn(BTZ)_2$) as white-emitting materials for organic EL devices.

EXPERIMENTAL

The chemical structures of the chelate-metal complexes used in this study were shown in FIGURE 1.



$Zn(BOX)_2$ $Zn(BTZ)_2$

FIGURE 1. Chemical structures of $Zn(BOX)_2$ and $Zn(BTZ)_2$.

The organic EL devices were prepared by the vacuum evaporation method. The pressure during the deposition was on the order of 10^{-6} Torr. The organic layers and Al cathode were vacuum deposited onto indium tin oxide coated glass substrate(Samsung Corning Co., Ltd.).

RESULT AND DISSCUSIONS

Four types of device structures were used in this experiment.

Device 1 : ITO/TPD(40nm)/$Zn(BTZ)_2$(60nm)/Al

Device 2 : ITO/TPD(40nm)/$Zn(BOX)_2$(60nm)/Al

Device 3 : ITO/TPD(40nm)/$Zn(BTZ)_2$(30nm)/$Zn(BOX)_2$(30nm)/Al

Device 4 : ITO/TPD(40nm)/$Zn(BOX)_2$(30nm)/$Zn(BTZ)_2$(30nm)/Al

The PL spectrum of $Zn(BTZ)_2$ and EL spectrum of the Device 1 were shown in FIGURE 2. The PL spectrum of $Zn(BOX)_2$ and EL spectrum of the Device 2 were also shown in FIGURE 3. In the Device 1 and Device 2, $Zn(BTZ)_2$ emitted greenish white light and $Zn(BOX)_2$ emitted blueish white light. Other devices such as Device 3 and Device 4 showed greenish white emission and blue emission.

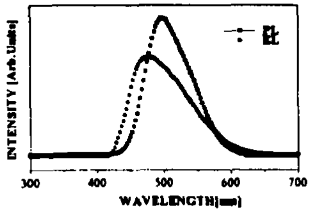


FIGURE 2. PL spectrum of the $Zn(BTZ)_2$ and EL spectrum of the Device 1.

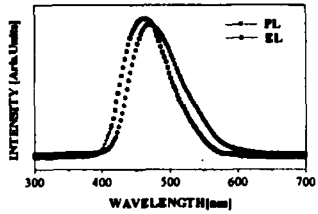


FIGURE 3. PL spectrum of the $Zn(BOX)_2$ and EL spectrum of the Device 2.

The PL and EL spectra of the $Zn(BTZ)_2$ and $Zn(BOX)_2$ showed very broad spectra. The PL emission peak of $Zn(BTZ)_2$ and $Zn(BOX)_2$ has been observed at the wavelength of 479nm and 461nm, respectively. It can be seen that the broad PL spectrum of this complex shows a half-spectral bandwidth of more than 100nm. Its peak wavelengths of 479nm and 461nm were in the green-blue region. EL spectra of $Zn(BTZ)_2$ and $Zn(BOX)_2$ show maximum emission at 497nm and 471nm, respectively. The EL spectra of $Zn(BTZ)_2$ and $Zn(BOX)_2$ are slightly different in the PL spectra. FIGURE 4 shows the dependence of the injection current on applied voltage in four devices under the forward bias condition. The operating voltages were similar to the all devices and found to be 12V. However, the current density of the Device 4 was about four times lower than that of others.

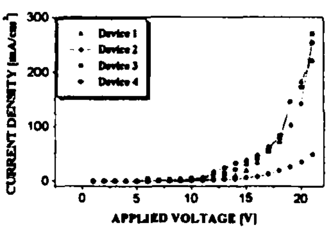


FIGURE 4. Current density-voltage (J-V) characteristics of all devices.

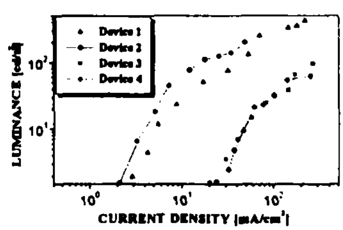


FIGURE 5. Luminance-current density (L-J) characteristics of all devices.

The reason for this low current density is that $Zn(BTZ)_2$ exhibits excellent electron transporting behavior in Device 4. Luminance-current density characteristics of all devices are shown in FIGURE 5. Luminance was proportional to the injection current. Luminance of Device 1 was higher than of all the other devices, but luminance efficiency was lower than Device 4. Luminance efficiency of the Device 4 was 0.124lm/W and that of Device 1 was 0.062lm/W. Device 2 was 0.017lm/W and Device 3 was 0.006lm/W. As a result, maximum luminance of Device 4 and Device 1 was 199cd/m^2 and 420cd/m^2, respectively. When $Zn(BTZ)_2$ was used as the emitting layer, luminance was high, but luminance efficiency was low. This indicates that $Zn(BTZ)_2$ is better than $Zn(BOX)_2$ as an electron transporting material[3]. The chelate-metal complexes such as $Zn(BTZ)_2$ and $Zn(BOX)_2$ are expected to serve as a new white emitting material for organic EL devices

CONCLUSION

The electroluminescent characteristics of chelate-metal complexes such as $Zn(BTZ)_2$ and $Zn(BOX)_2$ were investigated. $Zn(BTZ)_2$ showed greenish-white emission and $Zn(BOX)_2$ showed blueish-white emission. When $Zn(BTZ)_2$ was the emitting layer, luminance was high but luminance efficiency was low.

ACKNOWLEDGEMENTS

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