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The Optical Characteristics of the Light Emitting Device with TPD and PBD Thin Films

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The emission spectra generated from the electroluminescence (EL) devices on CuPC (copper phthalocyanine) / TPD (N,N'-diphenyl-N,N'-di(m-tolyl)-benzidine) / PBD (2-(4-biphenylyl)-5(4-tert-butyl-phenyl)-1,3,4-oxadiazole) had been studied. The EL devices emitted blue light two emission maxima, and one of them is about 50 nm bathochromic shifted from the photoluminescence maximum [2]. The bathochromic shift is caused by the new energy state generated under a high electric field [1].

Keywords exciton; transient; field effect; TPD; PBD

INTRODUCTION

The change in emission maximum in EL devices from the

photoluminescence maximum generated many problems in fabricationg blue emission devices. The emission maximum shift has been studied and may be caused by the field effect, aggregation of dye molecules [3,4]. In this work, we investigate the transient lifetime of EL, rising and falling times of two EL maxima of the devices, and electric field effects on emission spectra of the light emitting devices with TPD and PBD [4,6].

EXPERIMENTAL

All the materials were thermally evaporated at pressures blow 10^{-6} Torr without exposing the sample to the atmosphere. Procedures for transient measurements are described elsewhere. EL and PL spectra were measured using Perkin Elmer Limited LS50B.

RESULTS AND DISCUSSION

The PL maximum of TPD and PBD was at 400 nm and 420 nm, respectively [5]. However, the EL maximum obtained from the multiplayer devices was 460 nm [2]. The bathochromic shift may result from the aggregation of molecules either at the ground state or under high concentration TPD, PBD and their mixtures [1], whose spectra are shown in Figure 1. The lowest energy transition observed for these mixtures is 420 nm, which suggests that the excimer and exciplex can not generate 460 nm emission. The bathochromic shift for EL devices is due to the low energy transition from the excitons generated under high electric field. The shape of the spectrum does not change over the range of 10~18 V. Since the range of electric field applied to the

devices is high, we can not see the difference in EL spectra. Figure 2(a) shows transient EL spectra obtained at the wavelength of 410 nm and 460 nm during 10 μs electric pulse(12 V).

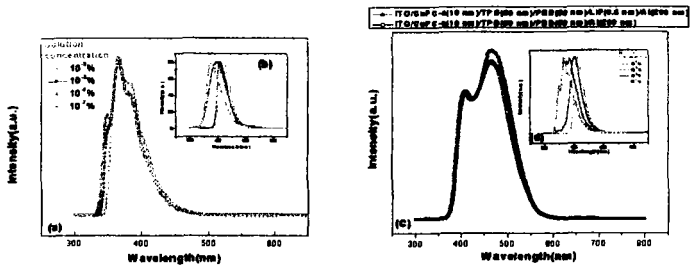

FIGURE1. Photolumlinescence (a) PBD (b) TPD (d) Mixed solution of TPD and PBD. (c) Electroluminescence.

The rising time is about 8 μs for both wavelength. In the case of 460 nm, the spectrum shows overshoot after cutting the electric field. It is interesting that the transient observed at 460 nm shows overshoot after 0.5 μs after cutting off the electric field and the decay time is dependent on the electric pulse width, Table 1.

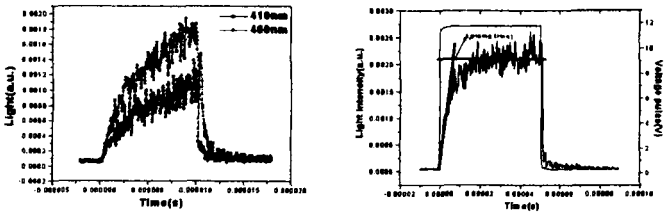

FIGURE 2. Transient EL spectra. (a) 10 μs pulse vltage (b) 50 μs pulse voltage.

The overshoot and slow decay of 460 nm transient may be due to the freezed aggregate excitons after the current flow was stopped . The current can generate thermal energy which facilitates the non-radiative decay from aggregate excitons under high electric field.

TABLE 1. Comparison among the different voltage pulse time for 460 nm.

Pulse (μs)	Overshoot Time(μs)	Time from offset of pulse to overshoot(μs)	Decay time (μs)
50	50.6	0.6	3.1
10	10.4	0.4	1.9
5	5.4	0.4	1.8

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REFERENCES

1. J. Kopecky, Organic Photochemistry: a Visual Approach (VCH Publishers, 1992).
2. P. Suppan, Chemistry and Light (The Royal Society of Chemistry, 1994).
3. T. Granlund, L. A.A Pettersson, J. Appl.. Phys. 81 (1997).
4. H. Cao, X. C. Gao and B. W. Zhang, Synth. Met. 96(1998) 191.
5. Edited by S. Miyata and H. S. Nalwa, Organic Electroluminescent Materials and Devices (Gordon and Breach Publishers, 1997).
6. A.J. Campbell, D.D.C. Bradley, J. Appl. Phys. 86 (1999)5004.