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# Structural Effects of TDAB Amorphous Hole Transporting Materials on Performance of Organic EL Device

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# Structural Effects of TDAB Amorphous Hole Transporting Materials on Performance of Organic EL Device

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For the fabrication of high stable organic electroluminescent device, we have synthesized amorphous molecular materials such as 1,3,5-tris(phenylphenylamino)benzene (TDAB), p-CITDAB, p-BrTDAB and p-MetTDAB as hole transporting materials and investigated ITO/p-XTDAB (X=Br, Cl, methoxy)/Alq<sub>3</sub>/Al device emitted green light. It has been found that organic EL device consisting of ITO/p-BrTDAB/Alq<sub>3</sub>/Al showed high EL intensity. Especially, the durability and EL performance of organic EL device using the amorphous hole transporting material were studied.

<u>Keywords</u> amorphous hole transporting materials; EL intensity; drive voltage; durability

#### INTRODUCTION

Recently, a great deal of progress in improving the performance of organic electroluminescent device has been achieved. However, low molecular-weight organic charge transporting materials generally tend to crystallize readily[1]. In the previous works, we have reported that the preparation and properties of p-BrTDAB amorphous molecular

material with high glass transition temperature as hole transporting material[2].

In this study, we have synthesized p-XTDAB amorphous molecular materials with various substituents (Br, Cl, methoxy) and investigated the structural effects of their substituents on thermal and optoelectrical properties.

#### MATERIALS AND EXPERIMENTAL

p-XTDAB (X=Cl, Br, methoxy) was synthesized by Ullmann reaction of 1,3,5-tris(phenylamino)benzene prepared with aniline, phloroglucinol and 4-chloroiodobenzene. The prepared product was purified by column chromatography using a silica gel and was identified as p-XTDAB through element analysis, spectroscopic measurements. HOMO level was estimated by CV (IM6) and UV-Visible (Jasco UV 570), respectively.

The *p*-XTDAB film as a hole transport layer was spin-casted from a monochlorobenzene solution onto the ITO coated glass. The speed of spin casting was about 2000 rpm. Alq<sub>3</sub> and Al were deposited by a ULVAC VPC-200F evaporator at a pressure below 1x10<sup>-5</sup> Torr. PL and EL spectra were obtained from the measurements of an Acton 300i spectrofluorometer. The morphology of *p*-XTDAB and TDAB were observed with an Auto Probe PSI AFM.

### RESULTS AND DISCUSSION

Cyclic voltammetry curves and UV-Visible spectra of TDAB and p-XTDAB (X=Cl, Br, methoxy) were shown in Figure 1 (a) and (b), respectively. We have investigated HOMO and LUMO levels of each amorphous molecular materials. It has been found that p-BrTDAB has the highest HOMO level.

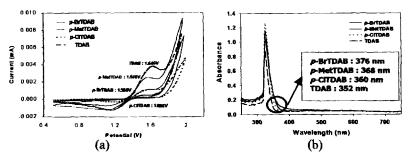


FIGURE 1 (a) Cyclic voltammetry and (b) UV-Visible spectra of TDAB and p-XTDAB.

Figure 2 showed the EL spectra and I-V characteristics of the EL devices consisting of ITO/TDAB or p-XTDAB/Alq<sub>3</sub>/Al. The EL device using p-BrTDAB exhibited high EL intensity and low drive voltage. It may be argued that this behavior is mainly due to the highest HOMO level and improvement of interface property.

Figure 3 showed the durability of EL device using p-BrTDAB was much better than that of EL device using TDAB. This phenomenon may be caused by the morphological stability of p-BrTDAB. The surface morphology of p-BrTDAB was not changed upon the heat treatment of 90 °C for 8 hrs.

Thus, it has been found that p-BrTDAB is an effective hole transporting material.

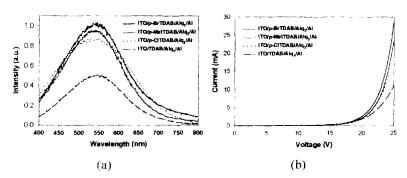


FIGURE 2 (a) EL spectra and (b) I-V characteristics of ITO/TDAB or p-XTDAB/Alq<sub>3</sub>/Al.

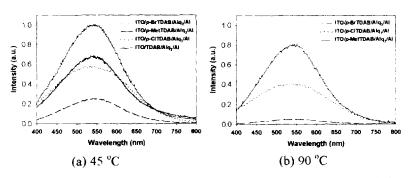


FIGURE 3 EL characteristics of ITO/TDAB or p-XTDAB/Alq<sub>3</sub>/Al after heat treatment for 8 hrs at (a) 45 °C and (b) 90 °C.

#### Acknowledgement

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