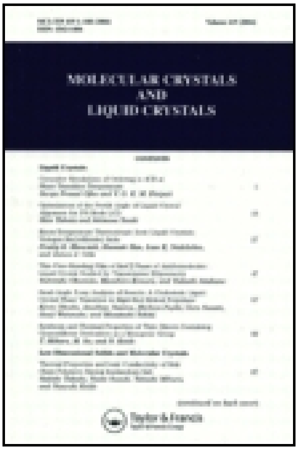

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The Hole Blocking Effect of 4,4′,4″-trifluorotriazine (tfTZ) in Electroluminescent Devices

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The Hole Blocking Effect of 4,4′,4″-trifluoro-triazine (tfTZ) in Electroluminescent Devices

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The hole blocking characteristics of 4,4',4"-trifluoro-triazine (tfTZ) were studied. The current density vs. voltage characteristics and the electroluminescence spectra of elelctroluminescent(EL) devices, which were fabricated with the structure of ITO/tfTZ/hole transport layer/emitting layer were measured. In this letter, we investigated the electrical and optical effects accompanied by the thickness change of tfTZ layer. In EL devices including tfTZ layer, current density and turn-on voltage decreased in comparison with those without tfTZ layer.

Keywords hole blocking layer; current density; turn-on voltage

INTRODUCTION

The charge injected at the interface of electrode passes transport layer and recombines in the emitting layer. The holes are outnumbered the electrons in hole transport and emitting layers, because hole mobility is fast than electron mobility in organic materials [1,2]. For the optimum recombination balance between holes and electrons, the excess holes had to controlled [3~5]. The organic EL device including tfTZ was expected carrier control effect because of high HOMO (highest occupied molecular orbital) level of tfTZ in comparison with TPD [1,6] (Figure.1). The energy band level of organic materials was measured by cyclic-voltammetry (CV) method. The high HOMO level of tfTZ contributes to the higher energy barrier for holes. As a result, current density and turn-on voltage of EL devices decreased.

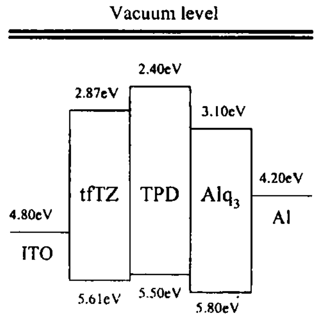

FIGURE.1
Energy level

In the present letter, we demonstrated the hole blocking effects of tfTZ by varying the thickness of hole blocking layer.

EXPERIMENTAL

The tfTZ was synthesized and characterized in Inha University. The structure of EL devices were either ITO/TPD (40 nm)/Alq_3 (60 nm)/Al, ITO/tfTZ (10,20,30,40 nm)/TPD (40 nm)/ Alq_3 (60 nm)/Al. TPD (N,N'-Diphenyl-N,N'-di(m-tolyl)-benzidine) was used as a hole transport material. Alq (8-Hydroxyquinoline aluminum salt) was used as an electron transport and emitting material.

RESULTS AND DISCUSSION

The tfTZ can generate stable evaporated films. The fluorine group raises the HOMO level, the high HOMO level blocks the holes more, efficiently.

Figure 2 shows the log of applied voltage and the log of current density characteristics of EL devices as function of tfTZ thickness. The current density of EL device including tfTZ layer is lowered compared with the device without tfTZ layer. The lowest current density is observed when

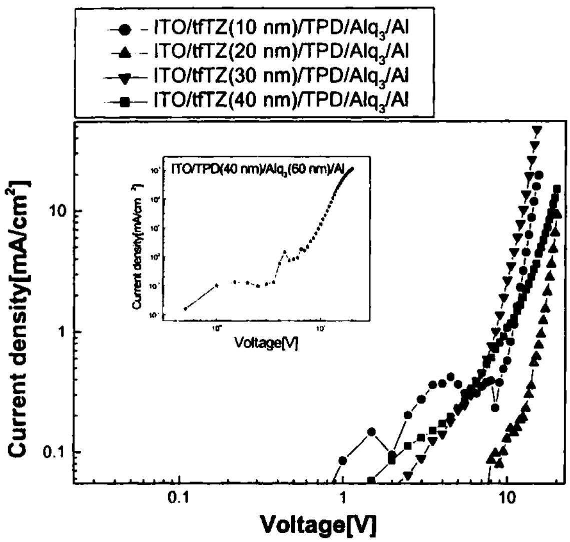

FIGURE 2 Applied voltage vs. current density of EL device

thickness of tfTZ is 20 nm. The HOMO level of tfTZ is lower than that of TPD (FIGURE 1), plays an important role in decreasing of current density and controlling of holes. The turn-on voltage of devices using tfTZ decreases as the thickness of tfTZ increase.

The external power efficiency is shown as a function of current density in Figure 3. The highest efficiency of device including tfTZ is observed at very low current density compared with the device without tfTZ.

The EL spectrum of device utilizing tfTZ is similar to that obtained from the device without tfTZ (Figure 4). This status indicates that the emission mechanism influenced as a shifting about 10 nm by tfTZ layer. [7]

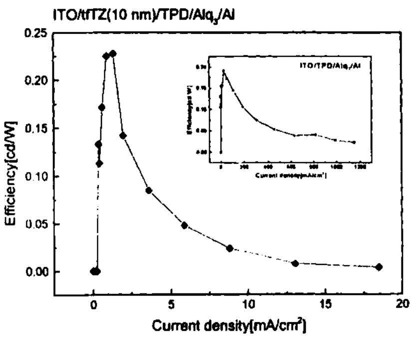

FIGURE 3 External power Efficiency vs. current density

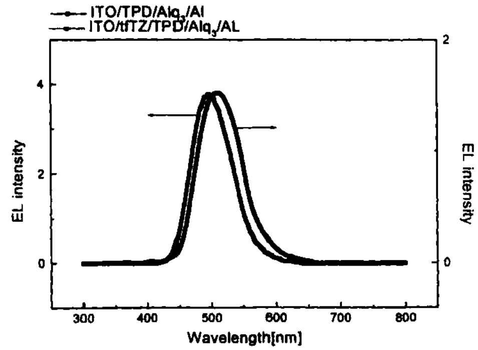

FIGURE 4 EL spectrum of device

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