Temperature Dependence Analysis of the OLED Device Lifetime with Our Electron Transport Material

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We use organic light-emitting diode (OLED) devices like smartphone in various conditions, so each OLED panel needs the stability at high temperature. In these surroundings, OLED materials are needed to be able to be used for a long time even in high temperature. Some researchers studied the temperature dependence about characteristics of OLED materials and devices [1-4], but few studies focus on the relationship between electron transport material (ETM) and device degradation with driving at high temperature. We demonstrated lower voltage, higher efficiency and longer lifetime in OLED devices using our new ETM (named ETM-1) than those devices using tris(8-hydroxy-quinolinate)aluminum (Alq_3) in this paper.

We fabricated blue OLED devices, ITO/HIL (70 nm)/HTL (10 nm)/blue EML (25 nm)/ETL (30 nm)/Liq (0.5 nm)/MgAg (80 nm)/Ag (20 nm) by evaporation method. The lifetime evaluation was conducted at constant current which brightens the device at 800 cd/m^2 initial luminance at room temperature (RT) and high temperatures (45 °C, 60 °C and 85 °C).

The results of lifetime are shown in Fig. 1. The lifetime using ETM-1 is longer than that of Alq_3 at each temperature. We think the carrier balance in devices and the differences of thermal stability of ETMs cause the difference of lifetime behavior at high temperature. Luminance spectrums of these devices are shown in Fig. 2. Blue shift is observed in each spectrum of the 85 °C devices, so we think other degradation mechanism, HTL degradation by electron may exist together in 85 °C.

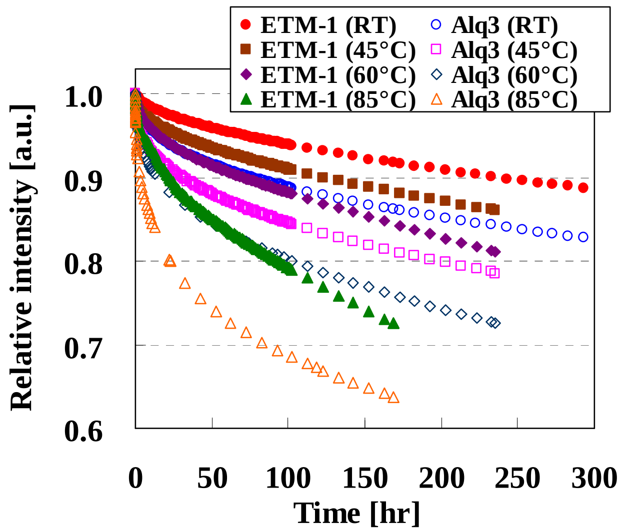

Fig. 1. Luminance changing of the devices with driving at constant current

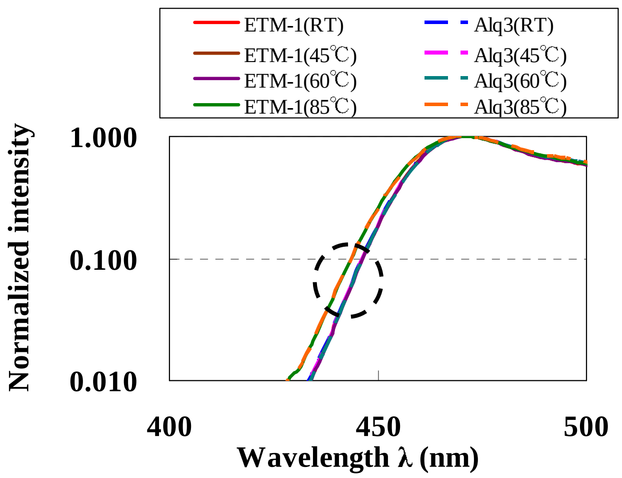

Fig. 2. Luminance spectrum of OLED devices

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