Characteristics of thermal activated delayed fluorescent organic light emitting diode as 4CzIPn doping concentration

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Novel organic light emitting diodes (OLEDs) utilizing up-conversion of triplet excitons into a singlet state can remarkably increase the external quantum efficiency (EQE) up to the values far beyond those obtained for conventional fluorescent OLEDs and comparable with those of phosphorescent OLEDs. Thermally activated delayed fluorescence (TADF) allows a light emission efficiency of nearly 100% from efficient spin up-conversion system from T_1 to S_1 state [1-3].

Because TADF materials show the emission delay phenomena due to the up-conversion system, a device with TADF shows the slow emission characteristics. So we analyzed transient EL that the TADF device with different doping concentrations in the emission layer. The green TADF device was fabricated as followed structure, ITO/HAT-CN(5 nm)/TAPC(50 nm)/mCP:4CzIPn(35 nm, X wt%)/TmPyPB(30 nm)/LiF(0.5 nm)/Al(100 nm). Here, emissive layer was composed mCP and (4s,6s)-2,4,5,6-tetra(9H-carbazol-9-yl)isophthalonitrile(4CzIPn) as a host and a dopant, respectively. And doping concentration was controlled from 1 to 15%. And we analyzed transient EL properties using 120Hz rectangular pulse by an oscilloscope and a high speed photodiode.

The delay time between applied voltage pulse and EL rising point are measured 8 nsec at 5 wt% and 6 nsec at 15 wt% at 9V, respectively. But, as doping concentration is increased from 5% to 15%, EL rising time increases from 498 nsec to 504 nsec.

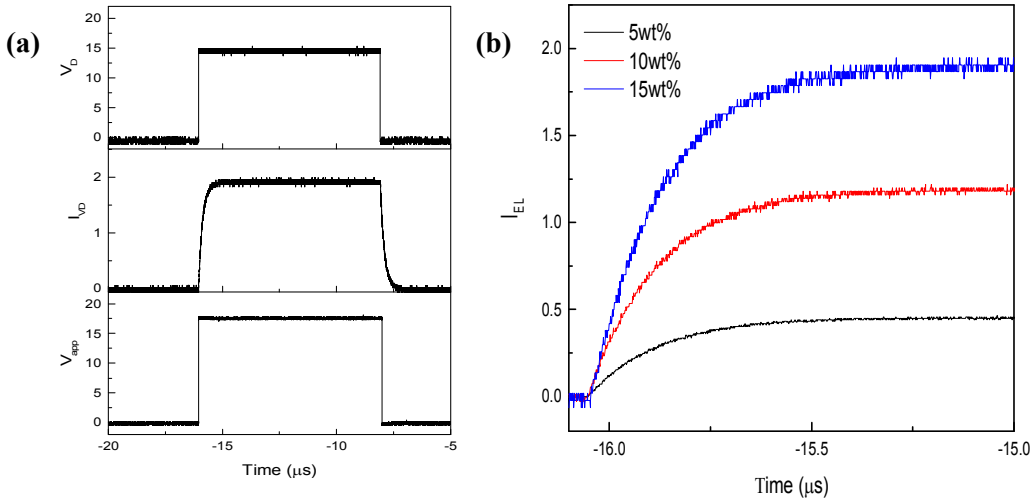

Fig. 1. (a) Transient EL characteristics at 9V 5%
(b) The delay time due to doping concentration

References

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