Investigation of the Green Emission Profile in PHOLED by Gasket Doping

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PHOLED devices which have the structure of ITO/HAT-CN(5nm)/NPB(50nm)/EML(30nm)/TPBi(10nm)/ Alq_3(20nm)/LiF(0.8nm)/Al(100nm) are fabricated to investigate the green emission profile in EML by using a gasket doping method. CBP and $Ir(ppy)_3$ (2% wt) are co-deposited homogeneously as a background material of EML for green PHOLED, then a 5nm thickness of additionally doped layer by $Ir(btp)_2$ (8% wt) is formed as a profiler of the green emission. As shown in Fig. 1, the total thickness of the EML is maintained at 30nm while the distance of the profiler from the HTL/EML interface side (x) is changed in 5nm steps from 0nm to 25nm. As shown in Fig. 2, the green (513nm) peak from $Ir(ppy)_3$ is not observed when $Ir(btp)_2$ is also doped homogeneously because $Ir(ppy)_3$ works as an gasket dopant of the $Ir(btp)_2$:CBP system. Therefore, in this experment, $Ir(btp)_2$ can be used as a profiler of the green emission in CBP:$Ir(ppy)_3$ system.

The emission spectra from the PHOLED devices with different x are shown in Fig. 3. In this gasket doping system, stronger red peak means more energy transfer from green to red dopant or higher exciton density by green dopant. To find the green emission profile, the external quantum efficiency (EQE) at 3mA/cm^2 for red peaks are calculated. More green light emission at near EML/HBL interface than that of HTL/EML is observed (insert of Fig. 3). This means that the higher exciton density at near EML/HBL interface in homogeneously doped CBP with $Ir(ppy)_3$. As shown in Fig. 4, excitons can be quenched easily to HTL(NPB) because the T_1 level of HTL(2.5eV) is relatively lower than that of EML(2.6eV). On the other hand, the T_1 level of HBL(2.7eV) is higher than that of EML.

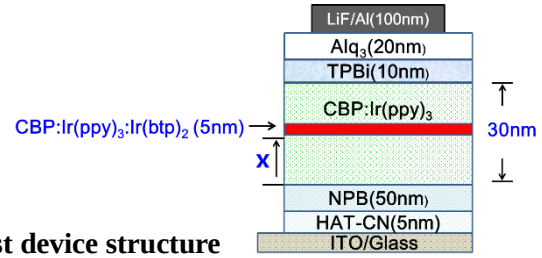

Fig. 1. Test device structure

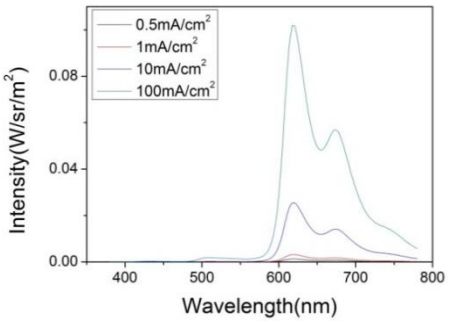

Fig. 2. EL characteristics from homogeneously co-deposited CBP with $Ir(ppy)_3$ and $Ir(btp)_2$

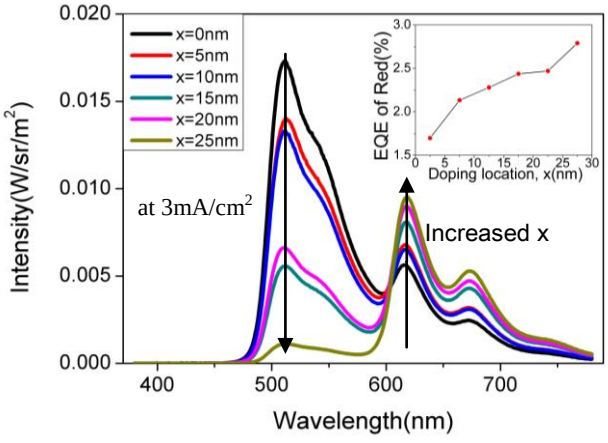

Fig. 3. EL characteristics and the green emission profile (insert) calculated from EQE of the red profiler

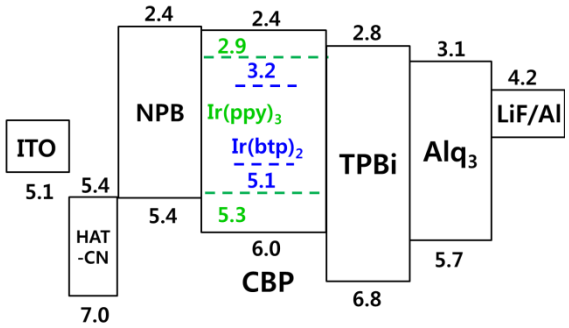

Fig. 4. The band diagram of the device

References
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