
Applying mixed host with newly synthesized p-type host to phosphorescent organic light-emitting diodes for high external quantum efficiency and low efficiency roll-off

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We designed and synthesized new p-type host which has similar structure with 1,3-di(9H-carbazol-9-yl)benzene (mCP). We measured photoluminescence spectrum and cyclic voltammetry of synthesized material. The host material showed 3.36 eV of singlet energy and 2.52 eV of triplet energy. And its energy of highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) is -5.64 eV and -2.45 eV respectively, which HOMO-LUMO gap is 3.19 eV. To test newly synthesized host material, we fabricate devices with yellow phosphorescent emitter, Iridium(III)bis(4-phenylthieno[3,2-c]pyridinato-N,C2')acetylacetonate (PO-01). Two kinds of devices were made, which is single host and mixed host device respectively. To make mixed host device, 2,2',2''-(1,3,5-Benzinetriyl)-tris(1-phenyl-1-H-benzimidazole) (TPBi) was used as a n-type host material. The doping concentration of yellow emitter is fixed with 5 weight percent in two devices. In OLED device, mixed host device showed better performance than single host device. The single host device showed 17.1% of external quantum efficiency (EQE). On the other hand, the mixed host device exhibited 22.2% of EQE and low efficiency roll-off. And also the mixed host device showed low driving voltage in comparison with single host device. This work demonstrated that new p-type host material can work effectively in phosphorescent OLED as a mixed host.