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Ideal host and guest system in red-to-orange organic light-emitting devices

Y. H. Park[1], Y. H. Shin[1], S. Y. Lee[1], Yongmin Kim[1]*, Honglae Sohn[2]

[1]*Department of Applied Physics, Dankook University, [2]Department of Chemistry, Chosun University

Bright and efficient organic light-emitting devices (OLED) have attracted considerable interest due to their potential applications for any kind of display devices from large area flat panel displays to mobile devices such as PDAs, mobile phones, digital cameras. Among the OLED family, materials such as DCM (4-(dicyanomethylene)-2-methyl-6-[(4-dimethylaninostyryl)-4-H-pyran]) which produce red color have relatively weak links within their molecular chains and are usually highly susceptible to concentration quenching. For this reason, they become either weakly emissive or even not emissive at all in solid state. Doping becomes an universal method to overcome such problems since the first high-performance red OLEDs were obtained by doping d guest red luminescent dye into an Alq_3 host matrix. The advantages of the doping method include easy color tuning, higher luminance, improved efficiency, and superior stability of the device. The phosphorescence emission in the conventional host-guest phosphorescent system occurs through the following two mechanism. Carriers transfer from the excited single S1 state of the host to the excited singlet Si state of the guest (Förster transfer) and from the excited triplet T1 state of the host to the excited triplet T state of the guest (Dexter transfer).

We present a series of OLEDs with the structure of ITO/TPD/HPAG:DCM1/Alq_3/LiF/Al have been fabricated which shows saturated color emission that can be varied from red to orange as the concentration of the guest molecule (DCM1) in the Ge based green emissive host 1,1-bis (2-phenylethynyl)-2,3,4,5-tetraphenylgermole (HPAG) electroluminescent layer is decreased from 10 wt% to 1 wt%. A peak emission wavelength and CIE(x, y) color index is 641 nm, (0.641, 0.358), respectively.