Reducing white organic light emitting diode spectrum shift by using hole blocking layers

(a)

LiQ/Al 100nm
Alq3 10nm
BP4mpy 30nm (ETL)
13% Iriprmi3:mCBP 10nm
4% PQIR:mCBP 10nm
8% Ir(ppy)$_3$: mCBP 5nm
TrisPCZ 5nm (HTL)
NPD 15nm(HTL)
HATCN 5nm (HIL)
ITO 150nm

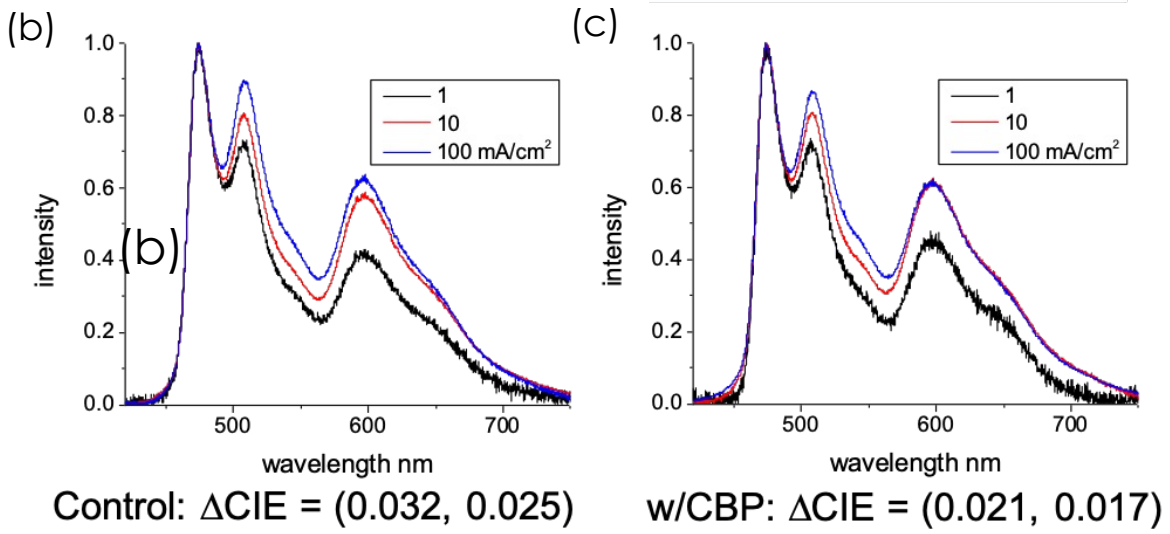

Figure: (a) Control WOLED structure. Spectra of WOLEDs working at 1-100 mA/cm^2 current density yielding (c) ΔCIE = (0.032, 0.025) and (d) ΔCIE = (0.021, 0.017)

Objective

- To reduce the color spectrum shift of WOLED operating at different current densities by employing hole blocking layers to improve charge balance in emission layers.

Impact

Despite the simplicity of the WOLED with a unified EML structure, it shows noticeable spectrum shift as the current density changes due to the spatial shift of the exciton formation zone in EMLs. Hole and electron currents injected into the EMLs are unbalanced because of the LUMO barrier between electron transport layers and EMLs. We propose to employ a hole blocking layer (5nm CBP) to impede the hole injection so that the rate of increase of both charge carrier currents with voltages are comparable. The exciton formation zone is hence stabilized and the WOLED spectra shift is reduced.

Facilities and Methods Used

- Vacuum thermal evaporation
- Exciton profile sensing

Funding

- US Department of Energy Solid State Lighting Office

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