Stable, deep blue tandem phosphor-sensitized OLEDs with double-sided polariton-enhanced Purcell effect

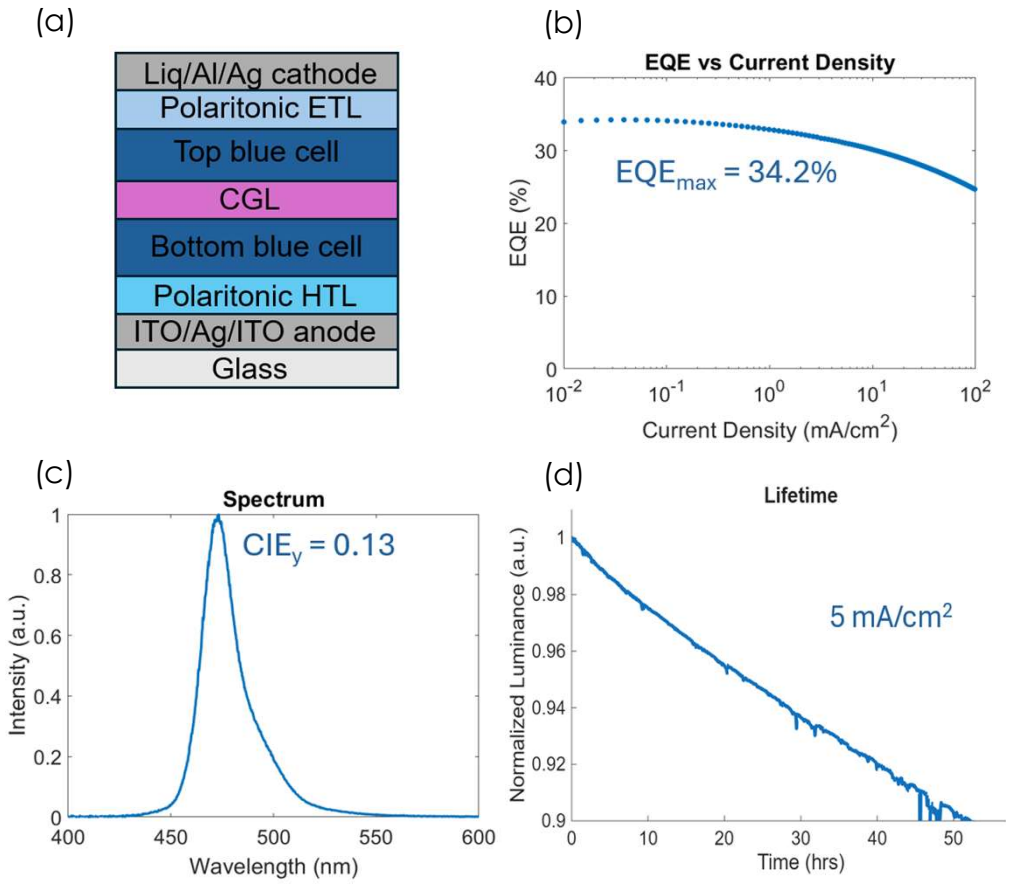

Figure: (a) Device heterostructure (b) EQE vs current density (c) electroluminescence spectrum (d) luminance decay vs time for deep blue tandem PSF OLEDs with double-sided PEP effect.

Objective

➢ To demonstrate deep blue OLEDs (CIEy < 0.15) with high efficiency and long lifetime utilizing phosphor sensitized fluorescence in a tandem structure with double-sided polariton-enhanced Purcell effect

Impact

Polariton-enhanced Purcell (PEP) effect is proven to suppress triplet density in blue phosphorescent OLEDs, leading to exceptional operational stability. Meanwhile, multi-resonant fluorescence emitters have emerged as leading candidates for narrowband deep blue emission. In this work, we combine these two approaches to realize phosphor sensitized fluorescence OLEDs employing PEP effect on both the cathode and anode sides of the organics stack. Additionally, we utilize a tandem structure with two stacked emissive units to achieve twice the brightness at the same current density. Such OLEDs achieve EQE > 34%, CIEy = 0.13 and time to decay to 90% of its initial value, LT90 = 52 ± 1 h when aged at 5 mA/cm^2 at an initial luminance, L_0 = 1500 ± 20 cd/m^2.

Facilities and Methods Used

- Vacuum thermal evaporation
- Chemical Vapor Deposition
- Photolithography
- Sputtering
- Chemical etching
- Metrology – SEM, optical microscopy
- JVL, electroluminescence and device lifetime setup

Relevant Papers

- H. Zhao, et al., Nature., DOI: 10.1038/s41586-023-06976-8
- H. Zhao, et al., Adv. Mater., DOI: 10.1002/adma.202507556

Funding

- US Department of Energy
- Universal Display Corporation

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