

Improving the reliability of thermally activated delayed fluorescence based organic light emitting diodes utilizing the Purcell effect

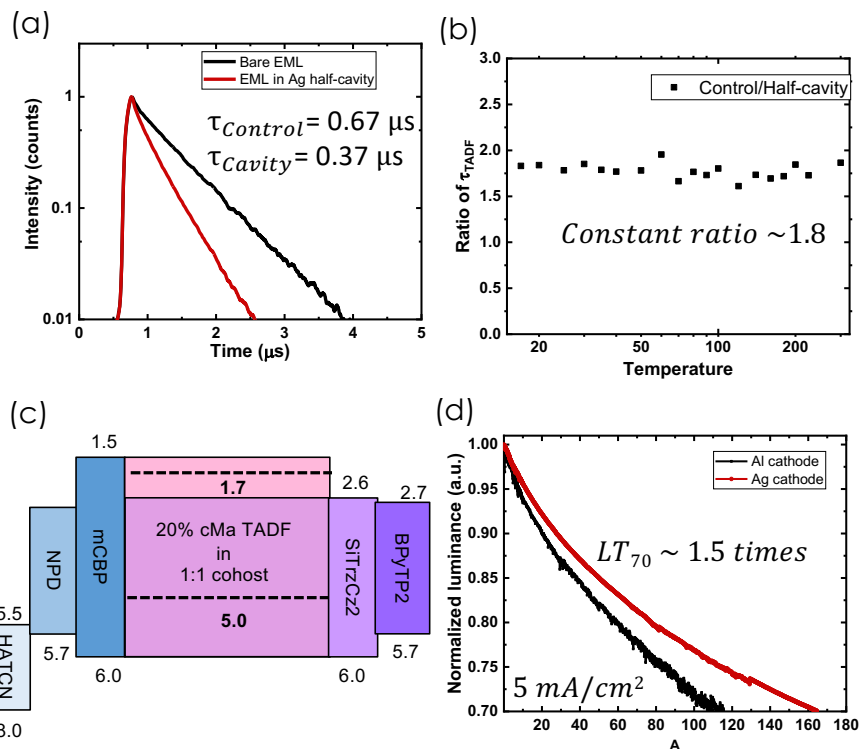


Figure: (a) Room temperature transient PL of cMa TADF dopant with and without Purcell cavity showing reduction in τ_{TADF} (b) Ratio of τ_{TADF} with and without Purcell cavity as a function of temperature showing constant reduction (c) Device schematic of fabricated TADF OLED (d) Luminance decay versus time showing lifetime enhancement due to Purcell effect

Objective

- To demonstrate extended device lifetime in TADF OLEDs by utilizing the Purcell cavity
- To gain fundamental understanding of the effect of Purcell cavity on the photo-physics of TADF emitters

Impact

The lifetime bottleneck for OLEDs arises from bimolecular annihilation processes involving the long-lived triplet state. Recent studies have shown that Purcell effect can reduce the triplet density in Ir-based phosphorescent OLEDs, and hence the probability of such destructive events. In this work, we extend the Purcell effect study to TADF based OLED transient decay and operational lifetime. We observe a ~ 0.55 times reduction in exciton radiative decay lifetime in the Purcell cavity and concomitantly demonstrate ~ 1.5 times increase in device operational lifetime. This work establishes the generality of Purcell effect in extending operational stability of OLEDs across various emission processes.

Facilities and Methods Used

- Vacuum thermal evaporation
- Time-resolved photo- and electroluminescence spectroscopy

Funding

- US Department of Energy
- Universal Display Corporation

Collaborators

- Group of Prof. Mark Thompson, USC

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