Increasing the radiative rates of triplet emitters to achieve long-lived and efficient phosphorescent OLEDs

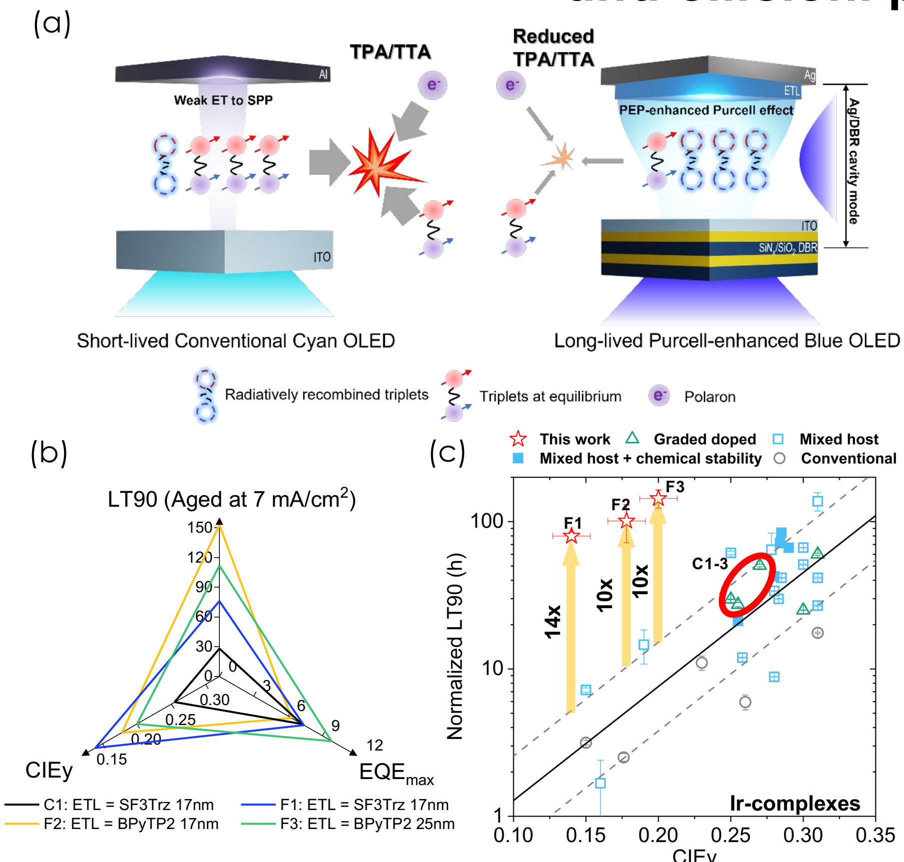

Figure: (a) Conventional device vs. full cavity device. Full cavity devices feature a polariton-enhanced Purcell effect and saturated blue emission (b) Spider plot of device performances enhanced by Purcell effect and microcavity. (c) Our results compared to similar device results up to publication.

Objective

- ➢ To extend blue and white OLED lifetime via increasing the radiative rates of triplets and reducing exciton density using microcavity effect

Impact

High WOLED efficiencies require utilization of both singlet and triplet excitons, which has involved metalorganic phosphors such as Ir- and Pt-based complexes, and thermally assisted delayed fluorescent (TADF) emitters. The principal source of molecular degradation leading to the very short blue triplet emitter OLED lifetime is triplet-triplet and triplet-polaron annihilation (TTA and TPA, respectively) due to high triplet density in conventional devices. Our approach to reducing TTA and TPA-induced device degradation is to shorten the radiative lifetime of the emitting molecule by tailoring the OLED optical cavity, which in turn will reduce the exciton density in the OLED emission zone.

Facilities and Methods Used

- Vacuum thermal evaporation
- Chemical vapor deposition
- Sputtering
- Lithography
- Time-resolved and angle-resolved photo- and electroluminescence
- Fourier plane imaging microscopy
- J-V-L and device lifetime testing station

Relevant Papers

- H. Zhao, et al., *Nature.*, DOI: 10.1038/s41586-023-06976-8
- C.E. Arneson, et al., *Adv. Func. Mater.*, DOI:10.1002/adfm.202410741

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