APPLICATION OF DIBENZOFURAN-BASED HOST MATERIALS FOR BLUE 3RD GENERATION THERMALLY ACTIVATED DELAYED FLUORESCENCE (TADF) ORGANIC LIGHT EMITTING DIODES

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Over the past decade, intensive research has been carried out on organic light-emitting diodes (OLEDs) employing thermally activated delayed fluorescence (TADF) emitters, which enable achieving 100% internal quantum efficiency [1]. While green and red OLEDs used in industry exhibit excellent efficiency and operational stability, blue devices still suffer from unresolved stability issues [2]. One possible approach to improving the stability of blue emitters is the synthesis and incorporation of new host materials into the device structure. The emitter molecules are dispersed in a host matrix to suppress concentration quenching and enhance charge transport. Importantly, the triplet energy level of the host material must be higher than that of the emitter to prevent reverse energy transfer from the emitter back to the host [3–4].

The aim of this study was to evaluate the suitability of three newly synthesized dibenzofuran-based host materials—A0, A1, and A2—for the fabrication of efficient and stable blue TADF OLEDs. The triplet energy levels of the host materials were determined using absorption and photoluminescence measurements, while the optimal concentration of the emitter DMeCzIPN [5] was established based on photoluminescence quantum yield (PLQY) measurements. The OLED devices were fabricated by vacuum deposition and subsequently electrically and optically characterized.

It was found that the triplet energies of hosts A0 and A1 are similar to that of the emitter, while A2 possesses a higher triplet energy. The optimal emitter concentration in all hosts was 20%. The devices achieved a maximum EQE of 8.1% and an LT_{50} of 2.5h at ~1000 cd/m^2, likely limited by crystallization of the organic layers. At low voltages, a broad green emission was observed due to exciplex formation between DMeCzIPN and the adjacent Tris-PCz layer. Introducing a 10 nm mCBP interlayer suppressed exciplex formation, significantly improving efficiency to EQE = 27% and extending LT_{50} to 11h, while also reducing crystallization effects.

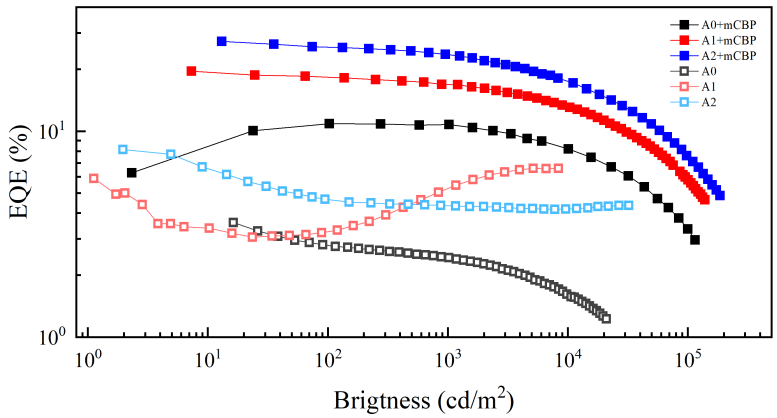

Fig. 1. External quantum efficiency curves as a function of brightness for OLEDs with A0, A1, and A2 host materials.

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