SOLUTION-PROCESSED BLUE TADF-OLEDs BASED ON TWISTED ISOPHTALONITRILES

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Due to the small singlet-triplet energy gap thermally activated delayed fluorescence (TADF) emitters can harvest all triplet excitons by upconversion to the singlet manifold and achieve up to 100% internal quantum efficiency [1]. Therefore they are attractive for replacing expensive phosphorescent emitters containing heavy metals and having issues with OLED stability in the blue spectral region [2]. Studied TADF emitters consist of carbazole (Cz) donor and isophtalonitrile (IPN) acceptor moieties. Such type of molecules are known to exhibit blue emission [3], however with significantly lower efficiency as compared to their green-emitting IPN counterparts [4].

In this work, photoluminescence properties of two IPN emitters, namely, unmodified DCzIPN [3] and modified DCzIPNMe were investigated. Methyl substituents were intentionally introduced at *ortho* positions of Cz moieties to alter TADF properties. The emitters were tested in solution-processed TADF OLEDs. An extra hole transport layer in OLEDs was introduced using crosslinking technique to ensure charge balance and exciton localisation in the emission layer [5].

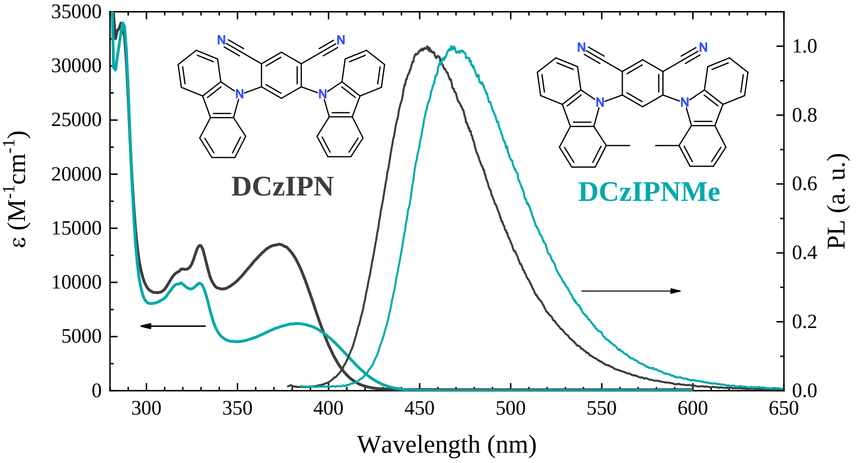

Fig. 1. Absorption and photoluminescence (PL) spectra of the studied isophtalonitrile TADF emitters (left), picture of blue emitting OLED based on DCzIPN emitter (right).

It was found that modified DCzIPNMe emitter dispersed in mCP host at 7 wt% concentration demonstrated enhanced charge transfer and TADF properties (~1.5 higher quantum efficiency and ~15 times larger delayed fluorescence rate). However, this modification of molecular structure resulted in reduced S_1 energy (by 72meV), thus making difficult to realize emission in a deep blue range. OLED containing modified DCzIPNMe emitter exhibited much higher external quantum efficiency (EQE_{max} = 17.5%) as compared to that with DCzIPN (EQE_{max} = 9.2%). Additionally, maximum EQE of DCzIPNMe-based OLED was achieved at several times higher current density and brightness levels as compared to DCzIPN. The obtained results imply great potential of the modified DCzIPNMe emitter for OLED applications.

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