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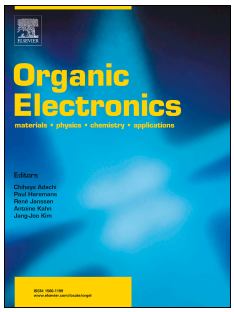

Blue thermally activated delayed fluorescence materials based on bi/tri-carbazole derivatives

Wenjuan Zhang, Ye-Xin Zhang, Xiao-Qing Zhang, Xiang-Yang Liu, Jian Fan, Liang-Sheng Liao

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Blue thermally activated delayed fluorescence materials based on bi/tri-carbazole derivatives

Wenjuan Zhang,[†] Ye-Xin Zhang,[†] Xiao-Qing Zhang, Xiang-Yang Liu, Jian Fan,* and Liang-Sheng Liao*

[a]Jiangsu Key Laboratory for Carbon-Based Functional Materials & Devices, Institute of Functional Nano & Soft Materials (FUNSOM), Soochow University, Suzhou, Jiangsu 215123, China

E-mail: jianfan@suda.edu.cn, lsliao@suda.edu.cn

[†]The two authors contribute equally to this paper

Three blue thermally activated delayed fluorescence materials (**Cy-2Cz**, **Cy-3Cz** and **Sf-3Cz**) based on bi/tri-carbazole derivatives have been designed and prepared. In **Cy-2Cz**, one bi-carbazole unit and one cyano group were covalently linked to the 2,2'-positions of one biphenyl motif. The molecular structure of **Cy-2Cz** is highly twisted due to the steric hindrance, which could efficiently break the π-conjugation within the molecule, thus leading to high triplet energy. The introduction of an additional carbazole unit into **Cy-2Cz** finished the synthesis of **Cy-3Cz**. The preparation of **Sf-3Cz** was accomplished by the replacement of the electron-withdrawing group biphenylcarbonitrile in **Cy-3Cz** with phenylsulfonylbenzene. Due to the incorporation of big rigid π-system, **Cy-3Cz** and **Sf-3Cz** exhibited excellent thermal stability with the glass transition temperature over 180^{o}C. These three carbazole derivatives showed small singlet-triplet energy gaps (ΔE_{ST}s) in the range of 0.16-0.31 eV. Therefore, thermally activated delayed fluorescence behavior was observed in these compounds with their photoluminescence quantum yields up to 97.2%. These blue TADF materials were applied in typical OLEDs as dopants and demonstrated high device efficiency. The blue OLED device based on **Cy-2Cz** at the doping level of 8 wt% achieved a maximum efficiency of 11.8 cd/A and external quantum efficiency (EQE) of 11.9% with the Commission Internationale de l'Eclairage (CIE) of (0.16, 0.10). An efficient blue fluorescent OLED based on **Sf-3Cz** was achieved with current efficiency of 19.2 cd/A and EQE of 15.8% with the CIE of (0.16, 0.14).