

Carbazolyl-Substituted Benzoic Anhydrides as Efficient Triplet Harvesters for High-Brightness Blue Organic Light-Emitting Diodes

Autorzy

Myroslava Aksionova
Khrystyna Ivaniuk
Roman Lytvyn
Stepan Kutsiy
Oskar Kaszubowski
Vasyl Kinzhybalo
Asta Dabulienė
Dmytro Volyniuk
Mykola D. Obushak
Juozas Vidas Grazulevicius
Mykhaylo A. Potopnyk

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Streszczenie

A simple and efficient synthetic strategy for the preparation of carbazole-based C_2 -symmetric anhydrides with donor-acceptor-donor (D-A-D) architecture is presented. Four benzoic anhydrides incorporating carbazole or 3,6-di-*tert*-butylcarbazole donor units, linked to the anhydride acceptor moiety through either *para*- or *ortho*-positions, are rationally designed, synthesized, and systematically investigated. Photophysical studies reveal a strong dependence of photophysical properties on the linkage topology. While *para*-linked derivatives exhibit neither delayed fluorescence nor phosphorescence, *ortho*-substituted anhydrides display small singlet-triplet energy gaps and consequently show thermally activated delayed fluorescence (TADF), as well as unexpected room-temperature phosphorescence (RTP). Therefore, compounds bearing *ortho*-linked carbazole donor moieties are successfully employed as triplet-harvesting emitters in sky-blue organic light-emitting diodes (OLEDs), delivering electroluminescence maxima at 475 and 481 nm, maximum external quantum efficiencies of up to 21.0%, high luminance exceeding 62 000 cd/m², and low efficiency roll-off. These results demonstrate that the formation of anhydrides from donor-substituted aromatic acids represents a versatile and effective design strategy for highly emissive TADF/RTP materials and provides a promising platform for the development of efficient multicolor OLED emitters through rational molecular engineering.

Słowa kluczowe

thermally activated delayed fluorescence, room-temperature phosphorescence, electroluminescence, OLED, low efficiency roll-off

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