Molecular Design of Hosts and Emitters for Long-Lived Delayed Fluorescence Organic Light-Emitting Diodes

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論 文 名　：Molecular Design of Hosts and Emitters for Long-Lived Delayed Fluorescence Organic Light-Emitting Diodes
（長寿命有機 EL のための TADF 分子及びそのホスト分子の研究）

区　　分　：甲

論　文　内　容　の　要　旨

This thesis endeavors to deliver the molecular design of host materials and TADF emitters for efficient and long-lived TADF OLEDs. First, Chapter 2 reports a new acceptor unit, benzimidazobenzothiazole (BID-BT), featuring a rigid configuration with benzimidazole as an electron-deficient moiety to aid electron transport, and benzothiazole as the backbone linked by a tertiary nitrogen atom as a bridge, with high triplet energy. A series of new bipolar host materials based on carbazole and BID-BT moieties were designed and synthesized. Both blue TADF and phosphorescent OLEDs containing BID-BT-based derivatives exhibit external quantum efficiencies as high as 20 %. Chapter 3 proposes a novel degradation mechanism for blue TADF OLEDs, where the combination of electro-oxidation and photo-oxidation efficiently decomposes high-energy triplets. By suppressing such a degradation process through molecular design and device engineering, the operational lifetime of blue TADF OLED has been dramatically improved. Chapter 4 extends this work and further demonstrates the n-type hosts are beneficial to enhance the operational stability of TADF OLEDs. Chapter 5 then introduces a new molecular design strategy for deep-blue TADF emitters. By introducing methyl groups in the proper position, the ΔE_{ST} of TADF molecules are well modulated without significantly changing their optical properties. Deep-blue OLEDs fabricated with these TADF emitters achieved high external quantum efficiencies over 19.2 % with CIE coordinates of (0.148, 0.098). Finally, this thesis will make conclusions and leave some future topics for further OLEDs especially TADF molecules with ultrafast reverse intersystem crossing rate (above 10^8 s^{-1}) research in Chapter 6.

〔作成要領〕

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