

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

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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)

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## 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  $\Delta E_{ST}$  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<sup>-1</sup>) research in Chapter 6.

〔作成要領〕

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