Holistic Molecular Design Strategies for High-Performance Organic Light-Emitting Diodes

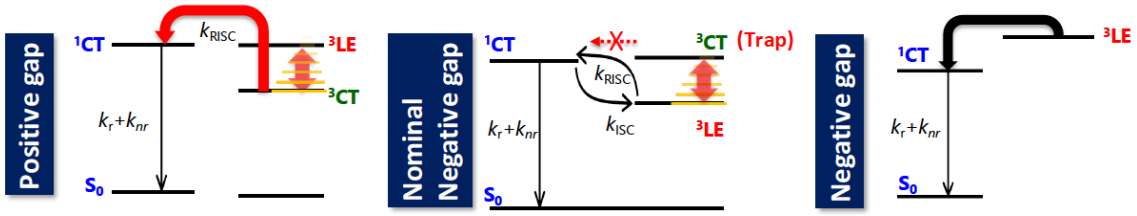
Chihaya Adachi

Center for Organic Photonics and Electronics Research (OPERA), Kyushu University
744 Motooka, Nishi, Fukuoka 819-0395, Japan
Email: adachi@opera.kyushu-u.ac.jp

Abstract

In the last 10 years, there have been a wide variety of studies on thermally activated delayed fluorescence (TADF)-OLEDs based on the unlimited possibilities of TADF molecular design[1]. Further, hyperfluorescence (HF)-OLEDs have been developed since they can realize the compatibility of high efficiency with narrow spectral width, which is ideal for practical display applications. The advanced HP-OLEDs realized high light-emitting performance by engineering host, TADF, and terminal emitter (TE) molecules, respectively. In this talk, we mention the comprehensive design principle for the materials used in HF-OLEDs by focusing on fast T-S upconversion, very small S-T gap, efficient FRET, GSP, and escaping carrier trapping aimed at high-performance OLEDs[2-5]. Further, we mention that high performance has been achieved through sophisticated molecular design based on various electron-donating and -accepting units, which control electrical conduction, exciton generation, charge separation processes, and even spontaneous dipole orientation in thin films.

From the aspect of charge transfer phenomena, we mention the improvement of the efficiency and durability of organic devices, clarify the correlation between individual molecular design and macroscopic device characteristics, and provide an overview of the future development of organic optoelectronic devices[6].



References

[1] T. Uoyama, et al., Nature, **492**, 234 (2012)

[2] C.-Y. Chan et al., Nature Photon., **15**, 203 (2021)

[3] Y.-T. Lee et al., Adv. Elect. Mater., **7**, 2001090 (2021)

[4] M. Tanaka et al., ACS Appl. Mater. & Inter., **12**, 50668 (2020)

[5] Y.-T. Lee et al., Nature Commun., **15**, 3659 (2024)

[6] S. Kondo, C. Adachi et al., Nature Commun., **15**, 8115 (2024)