Press Release

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Frontier Center for Organic Materials, Yamagata University
FLASK Corporation

Yamagata University and FLASK succeeded in development of long-lifetime next-generation organic LEDs at high-brightness

The research group of Prof. Junji Kido, Frontier Center for Organic Materials, Yamagata University (YU) and Dr. Takuya Komoda, FLASK Corporation (FLASK) has succeeded in developing stable organic light-emitting diodes (organic LEDs or OLEDs) at high brightness using 3rd-generation thermally activated delayed fluorescence (TADF) material.

At the brightness of 1,000 cd/m^2 for practical applications, half operational lifetime of about 10,000 hours, driving voltage of 4.15V, power efficiency of 54.3 lm/W and external guantum efficiency (EQE) of 21.6% have been achieved. The new organic LED shows approximately 1.5 times or more EQE as compared with that of previously reported while lifetime reaches 4 times longer.

An organic LED is a thin-film device that sandwiches an organic emitting layer and organic semiconductor layers between electrodes, which has advantageous characteristics such as uniform emission, high brightness, high contrast, low driving voltage, low power consumption, and ultra-slim size. Organic LEDs have come to be applied in smartphones, smart watches, high-grade televisions and lighting panels.

For display applications, further reduction of the power consumption is required while making the size larger. Substantial cost reduction is also required for widespread use. To meet these requirements, the development of third generation TADF materials has been expected which are free from expensive rare materials such as platinum and iridium. However, it remains a big issue to achieve low power consumption and long lifetime simultaneously.

The YU research group led by Prof. Kido and Prof. Hisahiro Sasabe together with Dr. Komoda of FLASK have been focusing on the use of highly-efficient and cost-competive TADF system in combination with new organic semiconductor material to realize energy-saving and low-cost organic LEDs. In TADF devices, the efficiency decrease at high brightness was significant in general due to unfavorable interaction between the carrier-transport material and the light-emitting material.

A researcher at Kido's group has found that a sterically bulky hole-transporter remarkably improved the lifetime of TADF devices even at high brightness. By introducing a novel hexaphenylbenzene-based bulky hole-transport layer named 4DBTHPB with deep ionization potential and high triplet energy, a highly-efficient and stable green TADF device has been obtained exhibiting EQE of 21.6 %, power efficiency of 54.3 lm/W and operation lifetime at 50% (LT50) of approximately 10,000 hours from the initial luminance of 1,000 cd/m^2. The newly developed 4DBTHPB has excellent stability against the injection of electrons by the desiged molecular structure with a dibenzothiophene moiety. Through these development, the lifetime was improved while maximizing the emitter's potential.

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