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Bipolar Host Development for 2nd and 3rd Generation OLEDs

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In the past few decades, OLED technology has smoothly evolved from conventional fluorescence-based devices (1st G) to nowadays thermally activated delayed fluorescence (TADF)-assisted fluorescence (TAF) devices (3.5 G) with remarkable electroluminescence (EL) efficiency improvements. The various practical OLED applications amid current consumer products have evidenced the promising future of this growing display technology. To achieve high efficiencies, balanced bipolar charge flow and intrinsically highly emissive material in device are the two most critical issues, receiving tremendous efforts from material scientists. In material chemistry, emitting layer comprised of appropriate bipolar host(s) with suitable emitter capable of delivering 100% internal quantum efficiency is the most widely adopted approach to simultaneously satisfy these two criteria in one simple way over different generation OLEDs. In this seminar, the design and synthesis of bipolar host materials for 2nd and 3rd generation OLEDs will be the main focus, which results in high OLED efficiencies. Through fine-tuned donor/acceptor number and/or molecular topology manipulation of the hosts, the charge balance in devices can be feasibly realized for a wide range colors of PhOLEDs under a common device architecture. By way of introducing multiple ortho-linkage, the dipolar hosts with congested conformation successfully impede direct donor/acceptor electronic interaction, leading to sufficiently high triplet energy to give highly efficient universal hosts for PhOLEDs. In addition, simple molecules with carbazole and cyano hybrid were designed for TADF OLEDs. The molecular design combining rational understanding of physical properties and efficient synthetic approach endows these materials as effective hosts for 2nd and 3rd generation OLEDs to produce outstanding optoelectronic properties.

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