

DESIGN OF NOVEL 3-(DIPHENYLAMINO)CARBAZOLE COMPOUNDS FOR MULTI-CHANNEL GREEN TADF OLEDs

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High-performance TADF emitters are currently in great demand for applications in full-color displays and solid-state lighting. These materials can reach up to 100% internal quantum efficiency without relying on noble metals. However, overall efficiency is still limited by slow and inefficient reverse intersystem crossing (RISC) processes [1]. Herein, we introduce a series of 3-(diphenylamino)carbazole-based compounds with a potential of multi-channel RISC. The structures of materials are shown in Fig. 1.

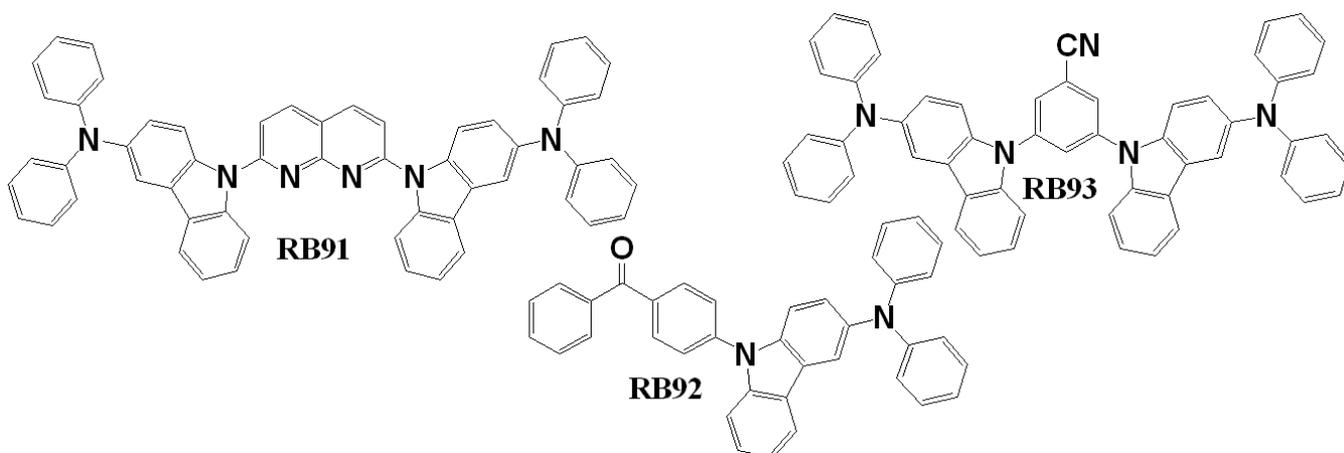


Fig. 1. Chemical structures of 3-(diphenylamino)carbazole-based derivatives

New compounds RB91, RB92, and RB93 were synthesized via Ullmann coupling and nucleophilic aromatic substitution. Their structures were confirmed by MS and NMR, and they showed excellent thermal stability ($T_d > 350$ °C) and good film-forming ability ($T_g = 90\text{--}145$ °C). All compounds exhibited green photoluminescence (optical gaps: 2.66–3.10 eV) and TADF with microsecond-range delayed lifetimes. Theoretical studies supported the experimental findings. Twelve OLEDs were fabricated using these emitters. RB91 emerged as the top performer, achieving a peak EQE of 12.87%, and highest current/power efficiencies (37.24 cd/A, 41.34 lm/W). This performance stems from RB91's small ΔE_{ST} (0.14 eV) and optimized excited-state properties, enabling efficient RISC and low efficiency roll-off at high brightness.

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