[4]-Cyclo-2,7-carbazole as host material in high-efficiency red Phosphorescent OLEDs: A new perspective for molecular nanohoops in organic electronics

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In the last ten years, the development of π-conjugated nanohoops has been considerable owing to their remarkable properties.[1] However, to date, their incorporation in organic electronic devices remains very scarce.[2] In this work, we report the first incorporation of a nanohoop, namely [4]-Cyclo-*N*-butyl-2,7-carbazole **[4]C-Bu-Cbz**, as host material in a high performance Phosphorescent Organic Light-Emitting Diode (PhOLED). Using the red phosphor $Ir(MDQ)_2(acac)$, the **[4]C-Bu-Cbz**-based PhOLED displays a very high External Quantum Efficiency (EQE) of 17.0 %, a Current Efficiency (CE) of 20.6 Cd/A and a Power Efficiency (PE) of 25.8 lm/W. This performance is significantly higher than that of its linear counterpart, *N*-butyl-2,7-quartercarbazole **[4]L-Bu-Cbz**, which displays an EQE of 11.1 %, a CE of 13.0 $cd.A^{-1}$ and a PE of 15.7 lm/W. This study, which includes emission, electrochemical, morphological and charge transport properties, shows that the best performances of **[4]C-Bu-Cbz** arises from (i) quicker radiative deactivation processes of the phosphorescent dopant in the emissive layer (EML), (ii) better transporting properties and (iii) higher homogeneity of the EML. Thus, nanohoops can be efficiently used as organic semi-conductors in electronics and opens the way to their practical uses in high-performance optoelectronic devices, which is now the next stage of their evolution.

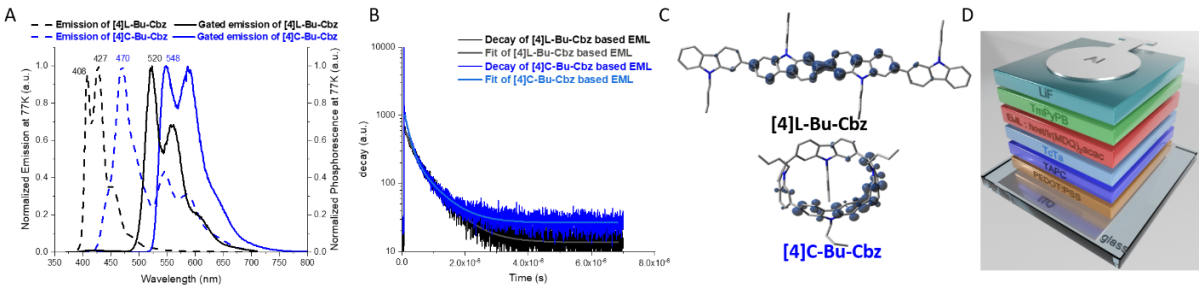

Figure 1. (A) Normalized emission at 77 K**;** (B) time resolved photoluminescence; (C) Triplet Spin Density distribution and (D) Schematic representation of the PhOLED.

[1] Darzi, E. R.; Jasti, R. *Chem. Soc. Rev.* **2015**, *44*, 6401.

[2] Leonhardt, E. J.; Jasti, R. *Nature Reviews Chemistry* **2019**, *3*, 672.