Development of Boron and Nitrogen-Doped Polycyclic Heteroaromatics Exhibiting Full-Color Narrowband Emissions

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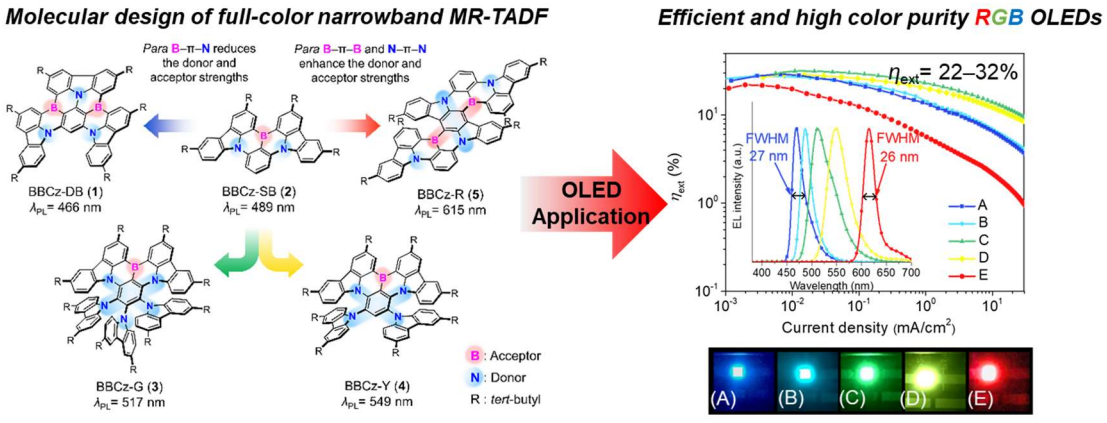
Polycyclic aromatic hydrocarbons (PAHs) have attracted immense interest because of their attractive optoelectronic properties associated with the rigid and planar π-conjugated frameworks. Incorporating main group elements into PAHs is an effective strategy to modulate the key properties of the parent π-conjugated systems.

Herein, we demonstrate that the strategic implementation of electron-accepting tricoordinate boron and electron-donating carbazole subunits into PAHs produces a family of attractive full-color luminophores that can emit narrowband thermally activated delayed fluorescence (TADF). These five compounds were synthesized through nucleophilic aromatic substitution reactions, followed by electrophilic borylations. In dilute solutions, these compounds exhibited full-color photoluminescence (PL) from deep blue to deep red (λ_{PL} = 466–615 nm) with full-width at half maxima as small as <40 nm and absolute PL quantum yields as high as 85%–98%. The transient PL decay measurements revealed the TADF characteristics. Owing to their ideal emission properties, we achieved, for the first time, full-color and narrowband organic light-emitting diodes based on this family of emitters. Notably, all devices showed impressively high maximum external electroluminescence quantum efficiencies of 22%–32%.[1]



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