Supporting information

Rational design of quinoxaline-based bipolar host materials for highly efficient red phosphorescent organic light-emitting diodes

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1. General information

All the solvents and chemicals used were purchased from commercial sources without further purification. The water used is double distilled. Tetrahydrofuran (THF) was purified by distillation over sodium under a N_2 atmosphere prior to use. All reactions were carried out under a N_2 atmosphere. All column chromatography was performed on silica gel (200-300 mesh) as the stationary phase. All materials were purified further by vacuum sublimation prior to fabrication of OLED devices. The nuclear magnetic resonance (NMR) spectra were recorded on a Bruker AM 400 spectrometer with tetramethylsilane as the internal standard. High-resolution mass spectra (HRMS) were measured on a Waters LCT Premier XE spectrometer. The ultraviolet-visible (UV-Vis) absorption spectra were obtained on a Varian Cary 500 spectrophotometer. Photoluminescence (PL) spectra were recorded on a Varian-Cary fluorescence spectrophotometer. The cyclic voltammetry experiments were performed by a Versastat II electrochemical work station (Princeton applied research) using a conventional three-electrode configuration with a glassy carbon working electrode, a Pt wire counter electrode, and a regular calomel reference electrode in saturated KCl solution. The oxidation and reduction potentials were measured in dry dichloromethane solution containing of 0.1 M *tetra*-n-butylammonium hexafluorophosphate ($TBAPF_6$) as the supporting electrolyte at a scan rate of 100 mV/s. The $E_{1/2}$ values were determined by $(E_{pa} + E_{pc})/2$ using Ferrocene as an external standard, where E_{pa} and E_{pc} were the anodic and catholic peak potentials, respectively. The differential scanning calorimetry (DSC) analysis was performed on a DSC Q2000 V24.11 Build 124 instrument with a heating

scan rate of 10 ^{o}C/min from 0 to 250 ^{o}C under nitrogen atmosphere. Thermogravimetric analysis (TGA) was carried out on the TGA instrument by measuring weight loss of samples with a heating scan rate of 10 ^{o}C/min from 50 to 800 ^{o}C under nitrogen.

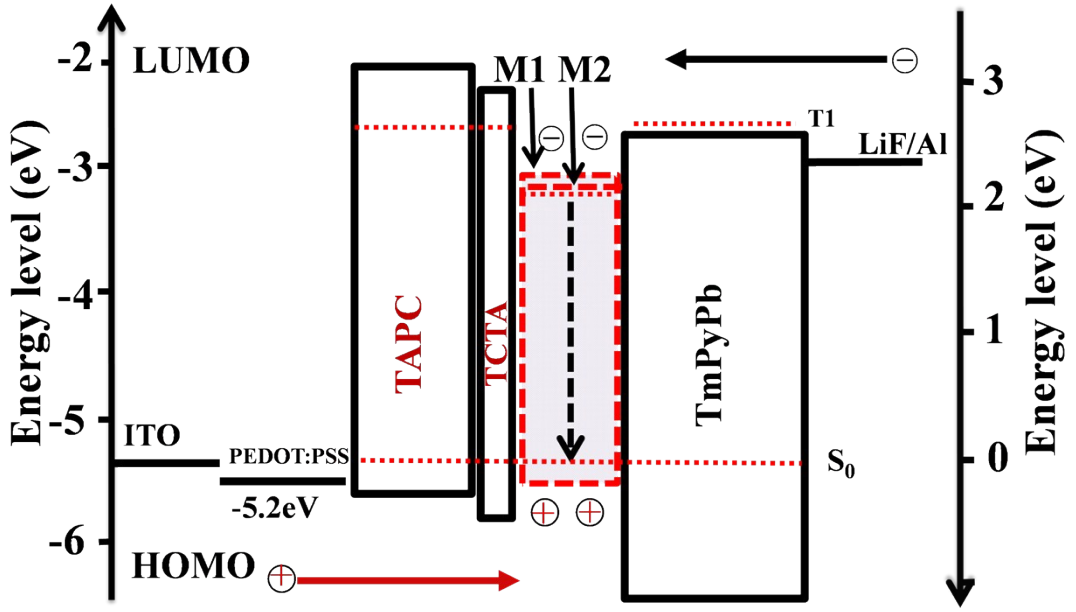


Figure S1. The energy level diagram for the M1- and M2-based red OLEDs in this work.

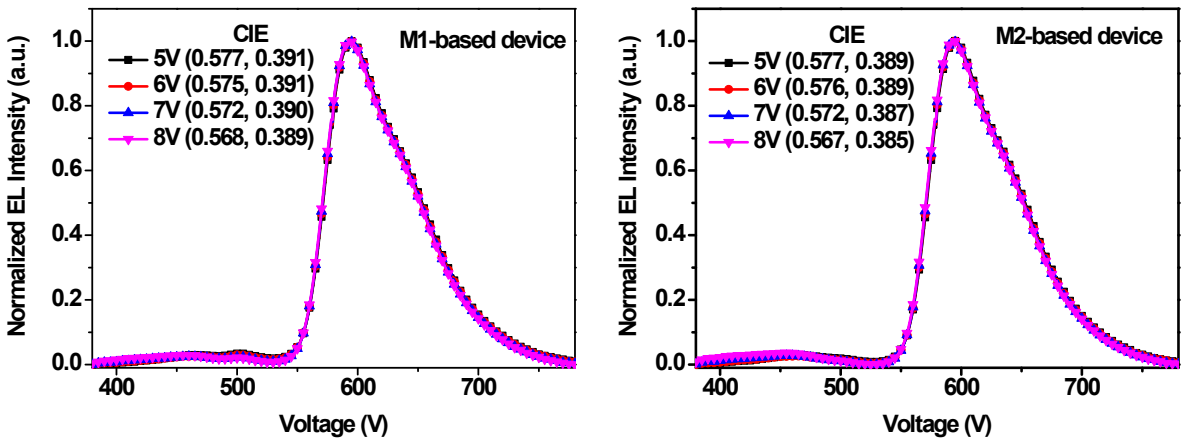


Figure S2. The Normalized EL spectra for the M1- and M2-based red OLEDs at a voltage range of 5V-8V.

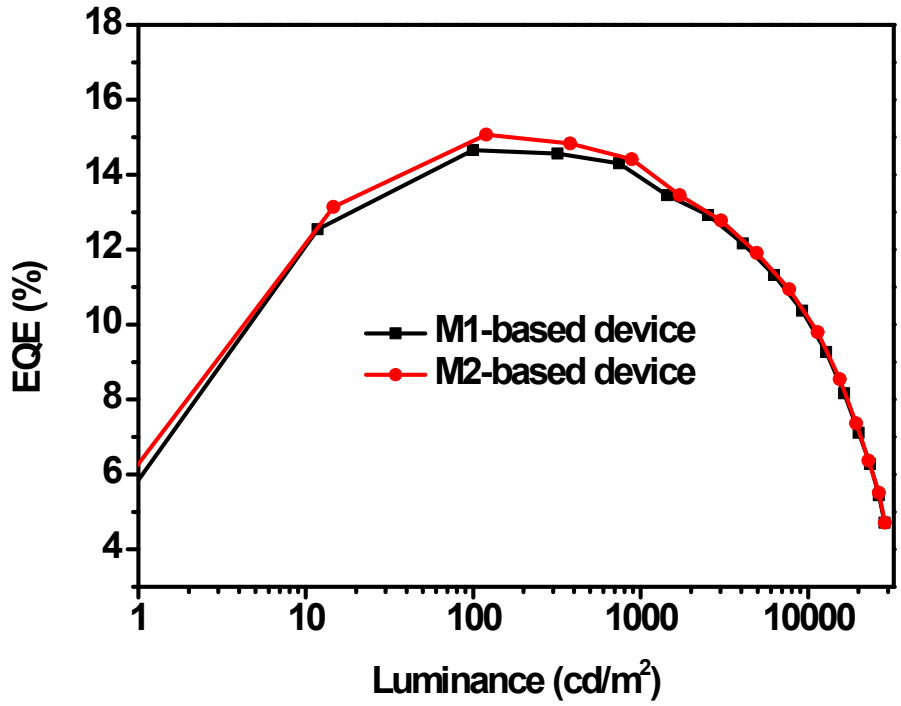


Figure S3. The EQE-luminance curves for the M1- and M2-based red OLEDs in this work.

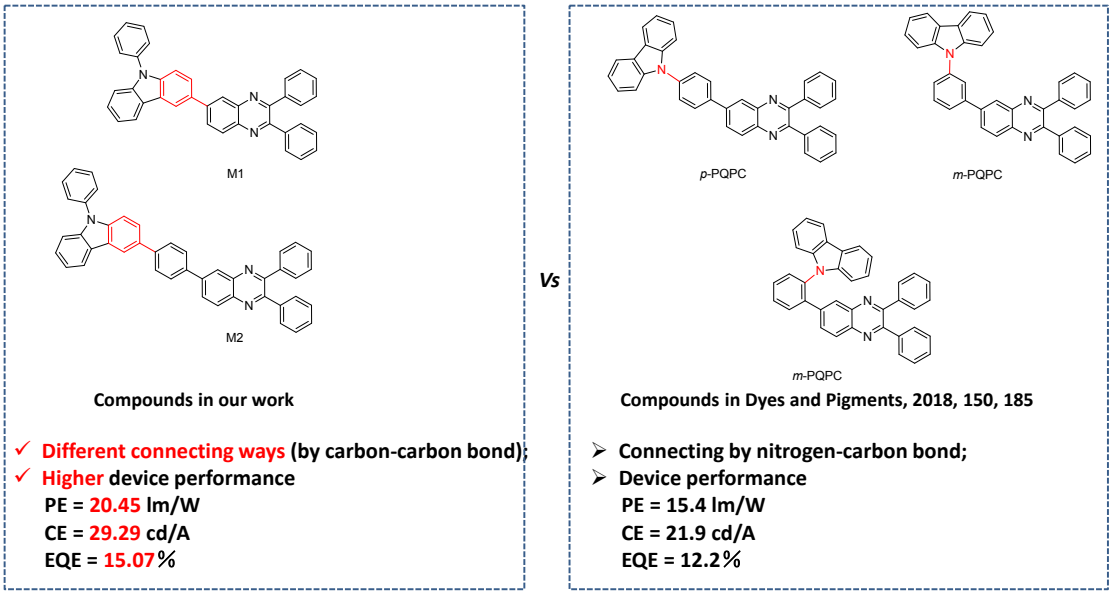
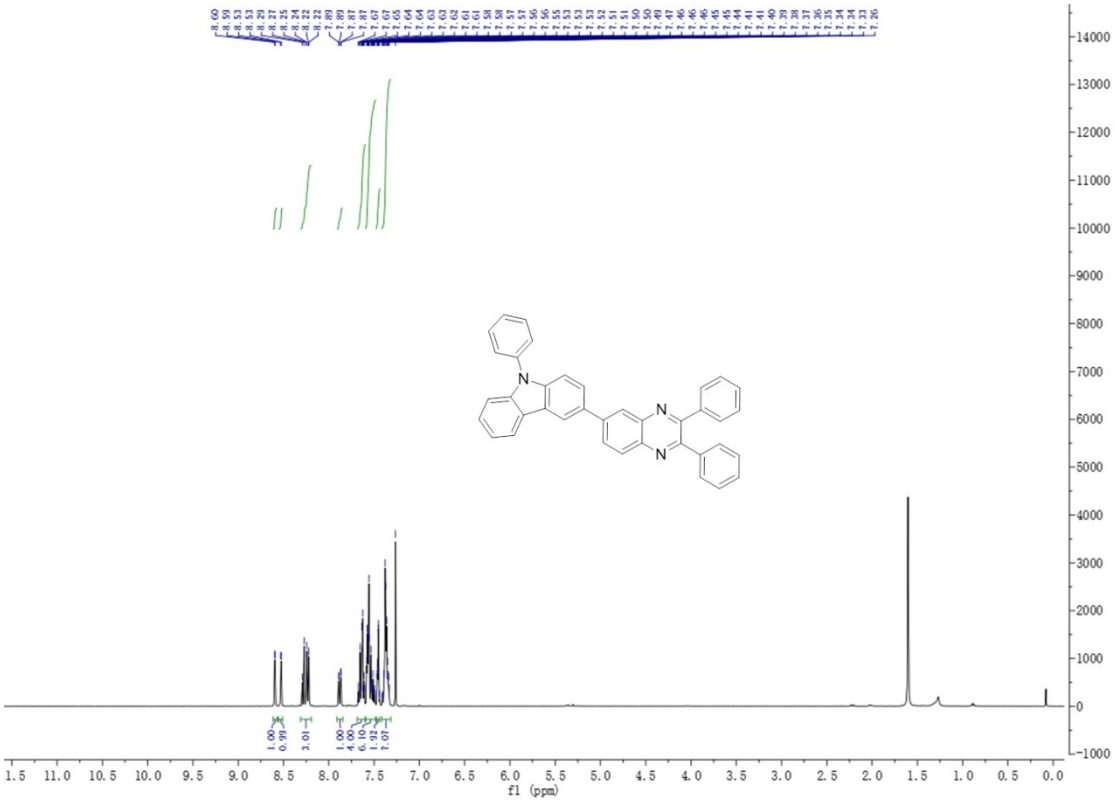
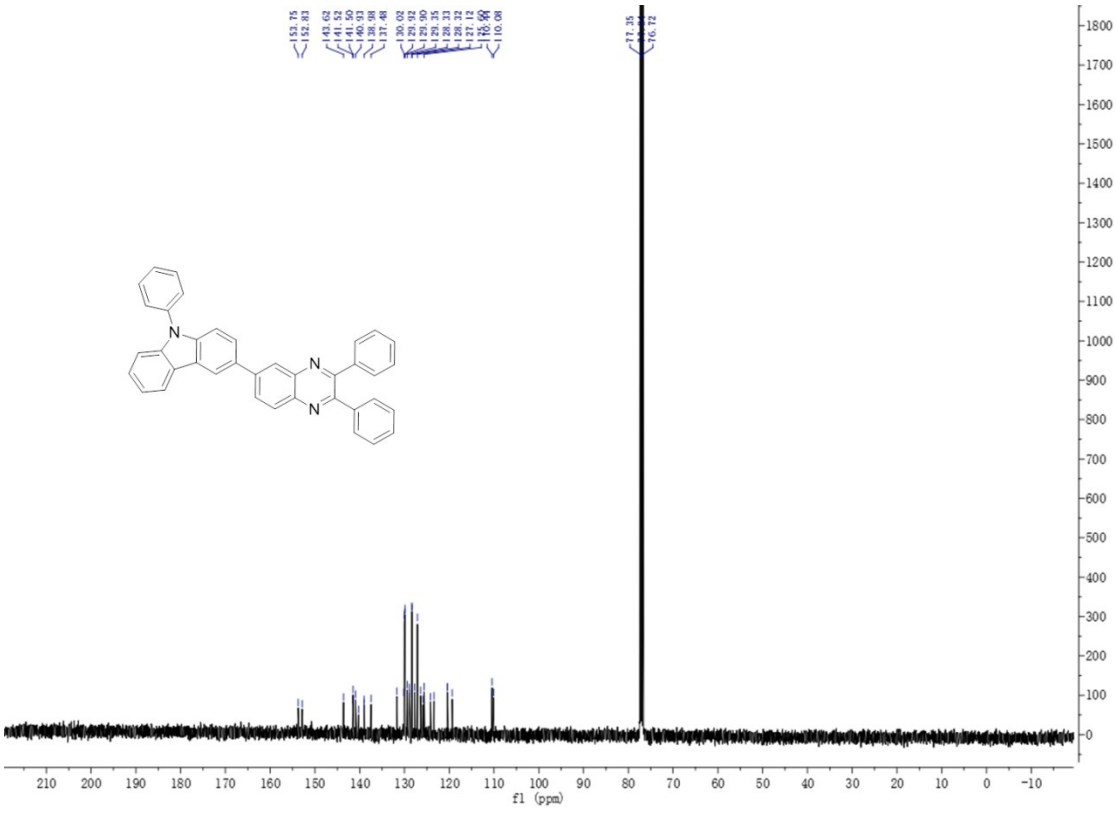


Figure S4. The comparison between our work and the reported article (Dyes and Pigments, 2018, 150, 185).

NMR spectra

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152.83
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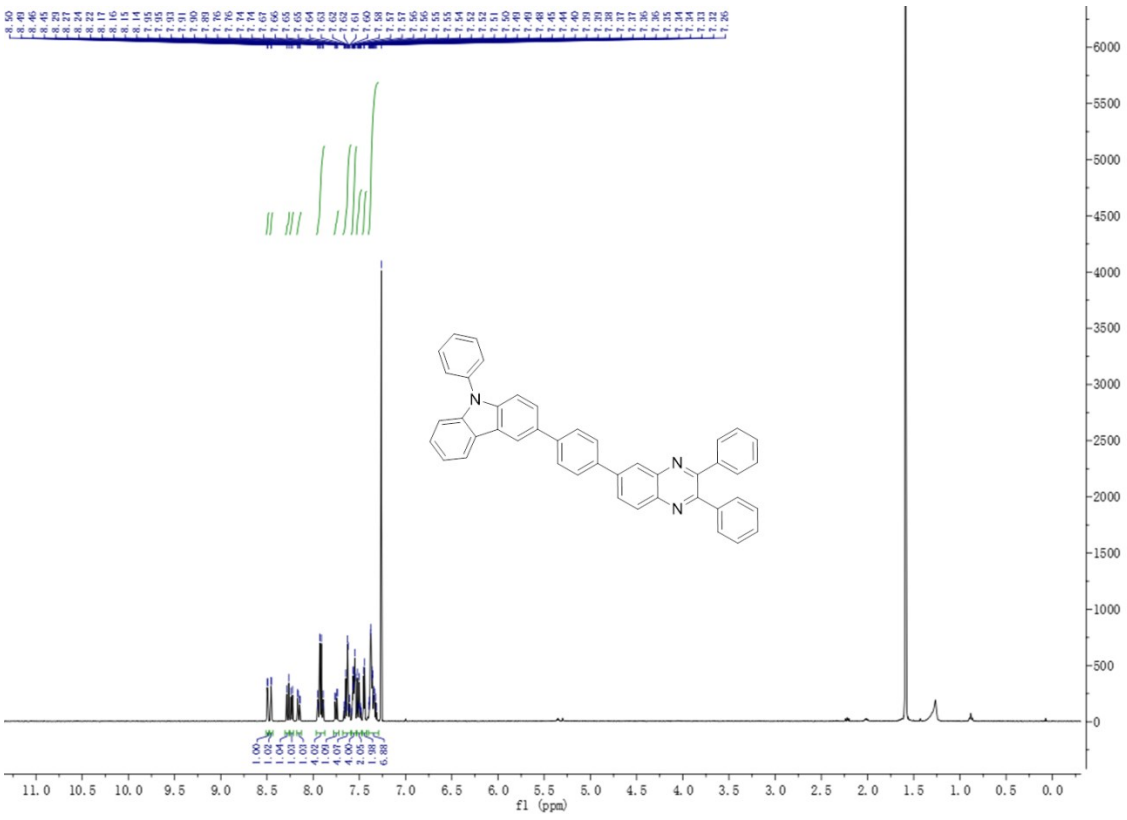
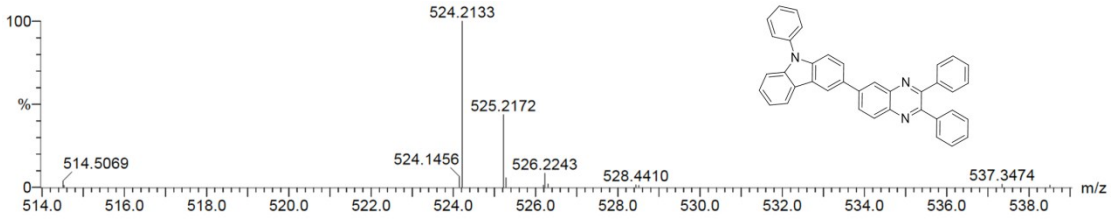
141.52
141.50
140.93
138.98
137.48
130.02
129.92
129.90
129.35
128.33
128.32
127.12
110.08
77.35
76.72
f1 (ppm)


f1 (ppm)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524.1456
526.2243
528.4410
537.3474
100
%
0
m/z
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516.0
518.0
520.0
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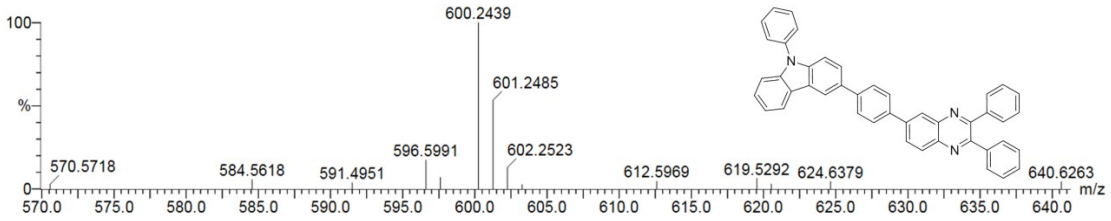
524.0
526.0
528.0
530.0
532.0
534.0
536.0
538.0
N
N
N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596.5991
602.2523
570.5718
584.5618
591.4951
612.5969
619.5292
624.6379
640.6263
100
%
0
m/z
570.0
575.0
580.0
585.0
590.0
595.0
600.0
605.0
610.0
615.0
620.0
625.0
630.0
635.0
640.0
N
N
N