

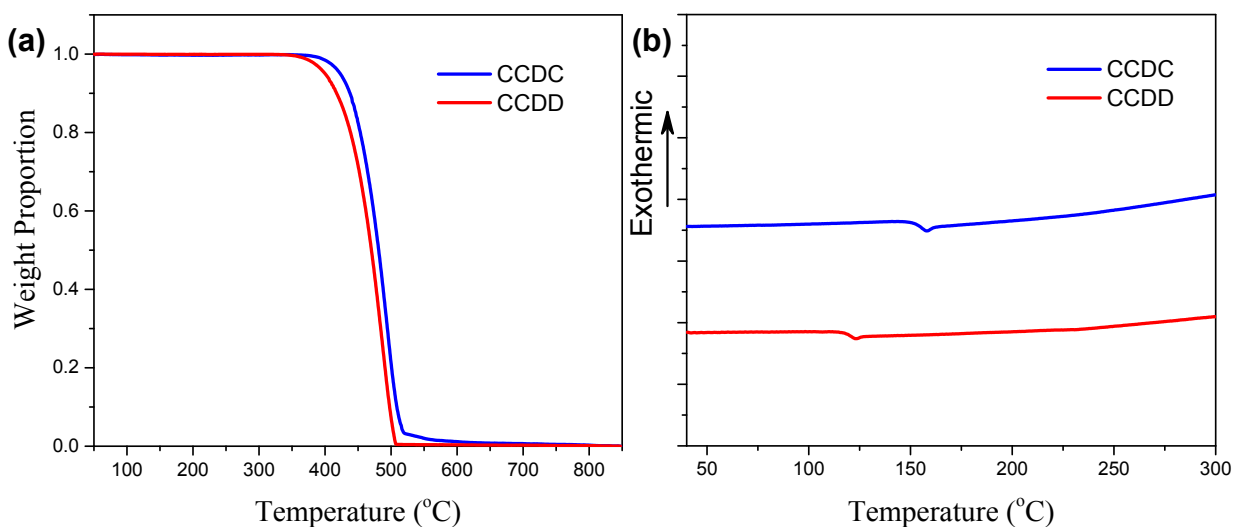
## SUPPLEMENTARY INFORMATION

# Highly Efficient Thermally Activated Delayed Fluorescence Materials with Reduced Efficiency Roll-Off and Low On-Set Voltage

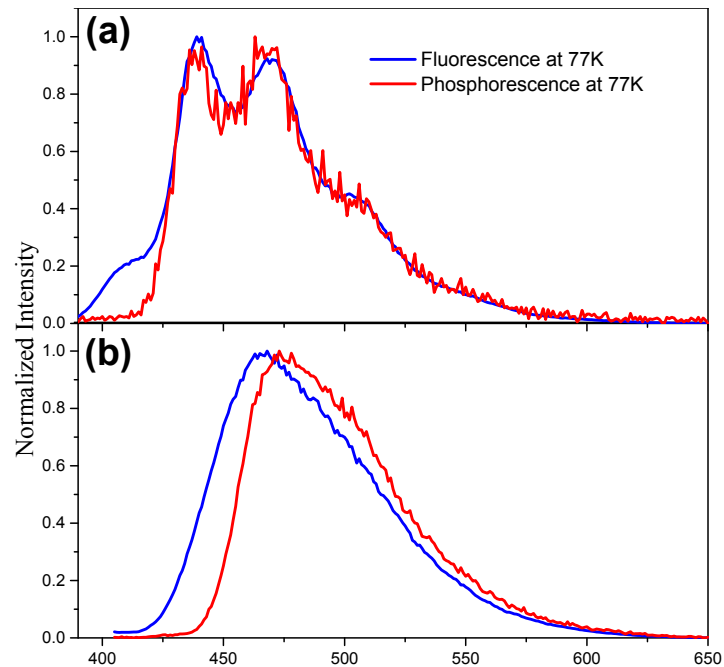
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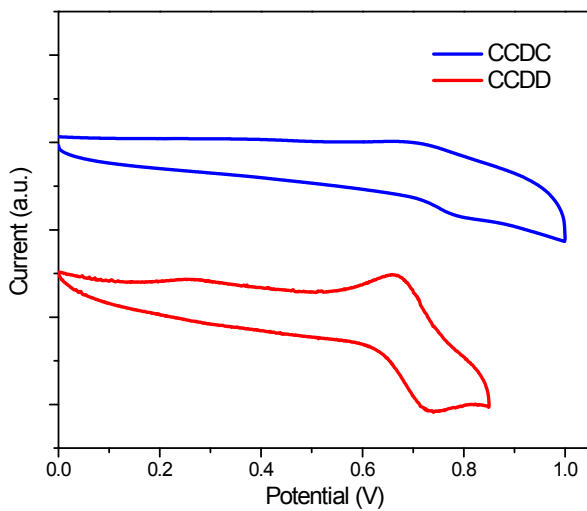
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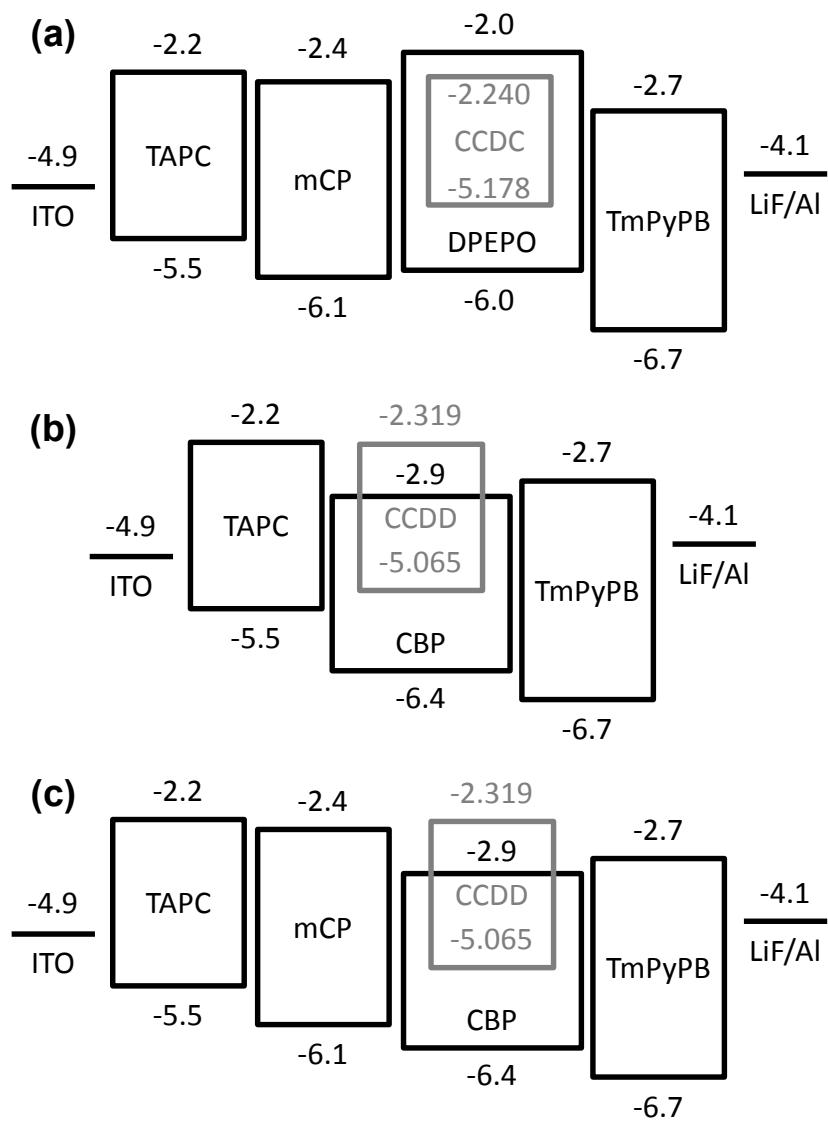
**Fig. S1** (a) TGA thermograms of CCDC and CCDD recorded at a heating rate of  $10^{\circ}\text{C min}^{-1}$ ; (b) DSC curves of CCDC and CCDD recorded during the second heating scan.



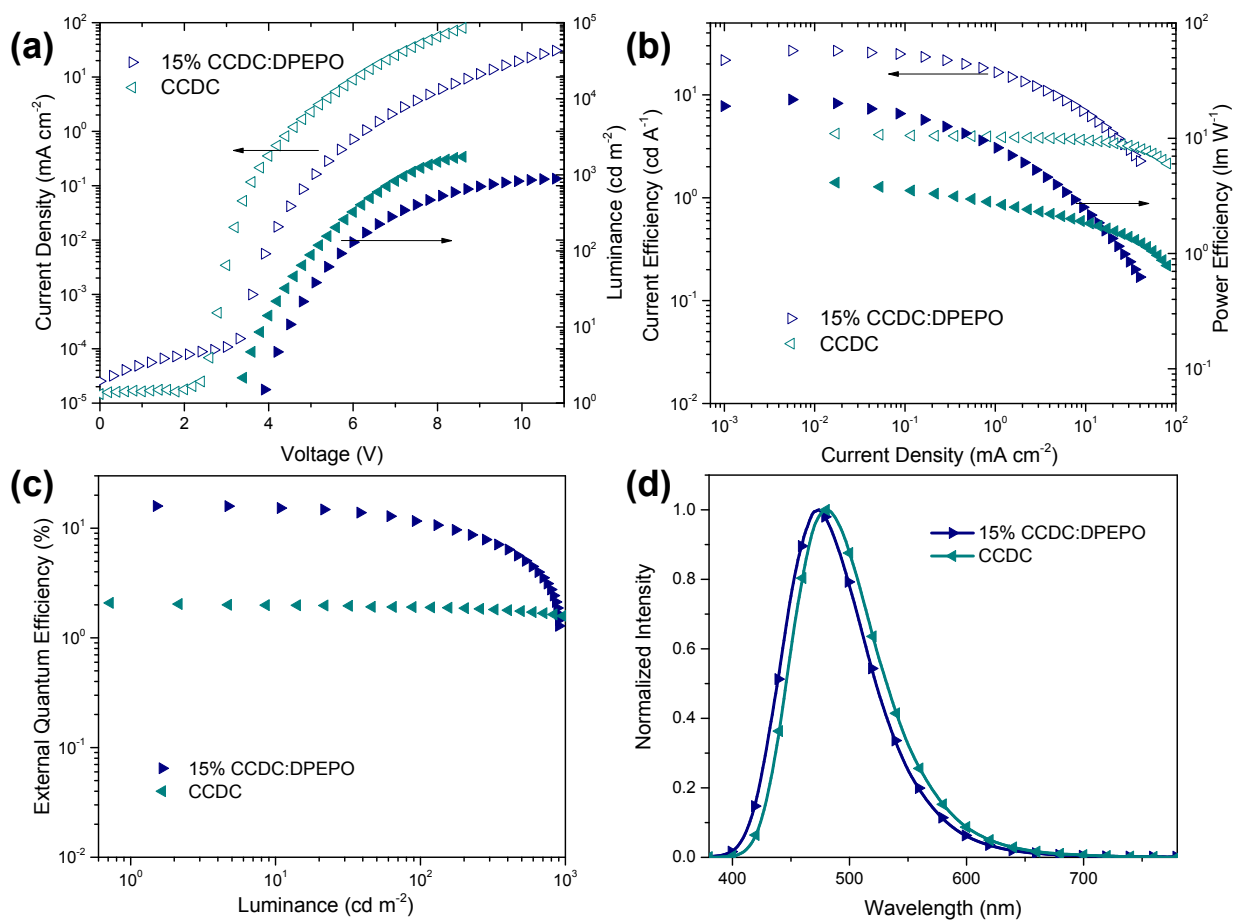
**Fig. S2** Normalized fluorescence and phosphorescence spectra of CCDC (a) and CCDD (b) in toluene at 77 K.



**Fig. S3** Cyclic voltammograms of CCDC and CCDD measured in solvent of dichloromethane/acetonitrile (4:1, vol).



**Fig. S4** Energy level diagrams of the devices based on (a) CCDC and (b) (c) CCDD.

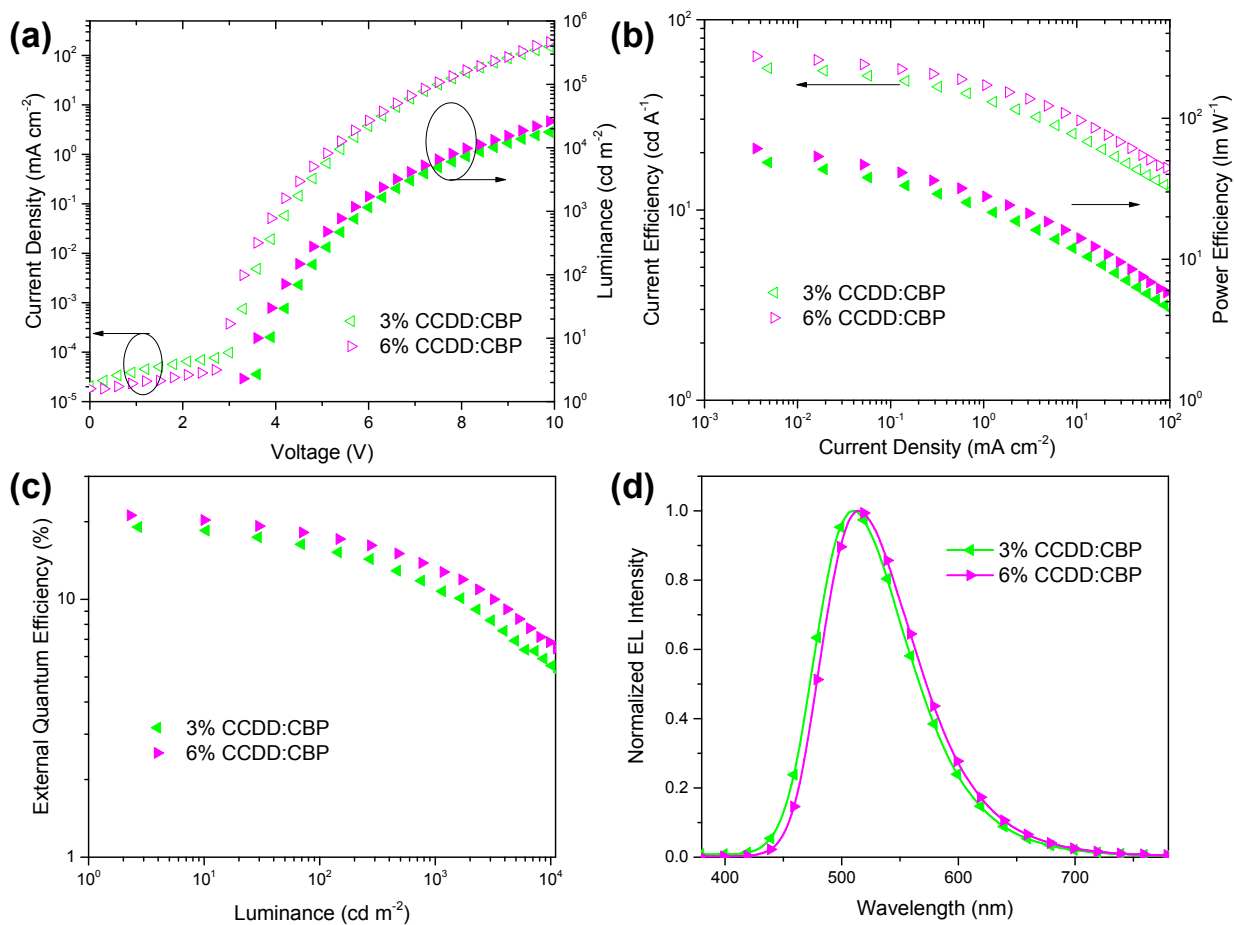


**Fig. S5** (a) Current density and luminance versus driving voltage; (b) current efficiency and power efficiency versus current density; (c) external quantum efficiency (EQE) versus luminance characteristics and (d) EL spectra of the CCDC-based devices at 1 mA cm<sup>-2</sup>.

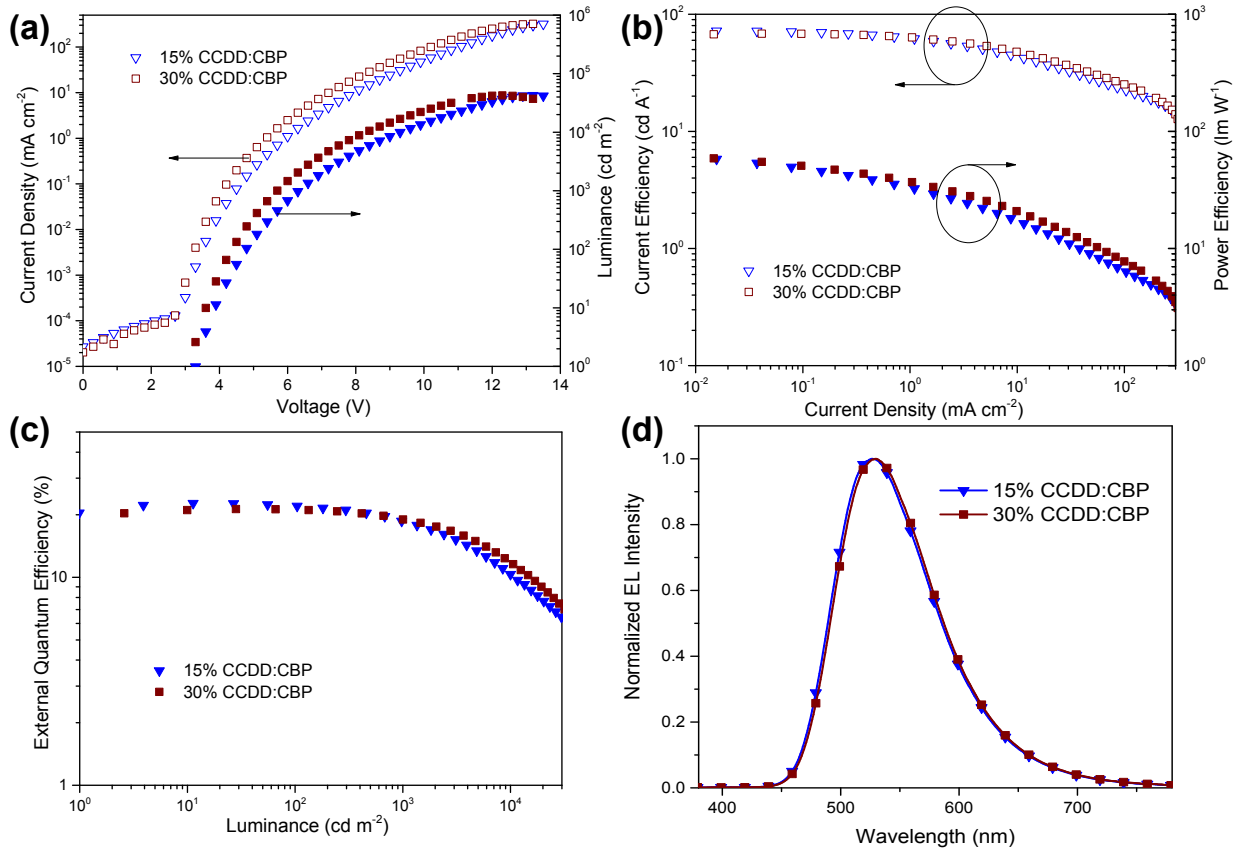
**Table S1** Electroluminescence Properties of the CCDC-based devices

EML	$V_{ON}^a$ (V)	Max. Efficiency			$EQE_{100}^a$ (%)	CIE (x, y) (@ 1mA cm <sup>2</sup> )
		$CE_{max}$ (cd/A)	$PE_{max}$ (lm/W)	$EQE_{max}$ (%)		
15 wt% CCDC:DPEPO	3.8	26.9	22.2	15.9	11.4	(0.165, 0.239)
CCDC	3.3	4.20	4.12	2.08	1.53	(0.214, 0.351)

<sup>a</sup> $V_{ON}$  and  $EQE_{100}$  are obtained at the luminance of 1 and 100 cd m<sup>-2</sup> respectively.



**Fig. S6** (a) Current density and luminance versus driving voltage; (b) current efficiency and power efficiency versus current density; (c) external quantum efficiency (EQE) versus luminance characteristics and (d) EL spectra of the CCDD-based devices at the concentrations of 3 and 6 wt% at  $1 \text{ mA cm}^{-2}$ .



**Fig. S7** (a) Current density and luminance versus driving voltage; (b) current efficiency and power efficiency versus current density; (c) external quantum efficiency (EQE) versus luminance characteristics and (d) EL spectra of the CCDD-based devices at the concentrations of 15 and 30 wt% with an mCP layer at  $1 \text{ mA cm}^{-2}$ .

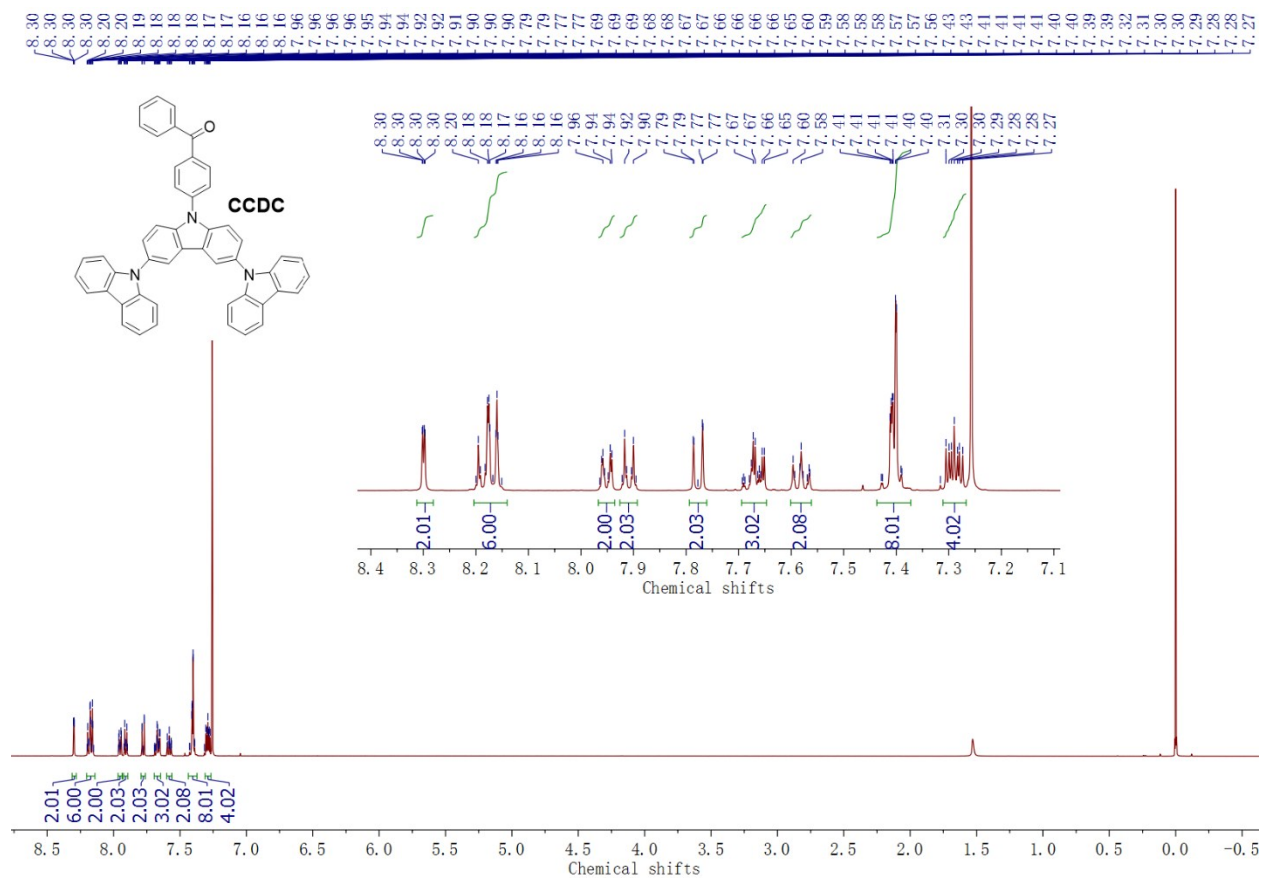
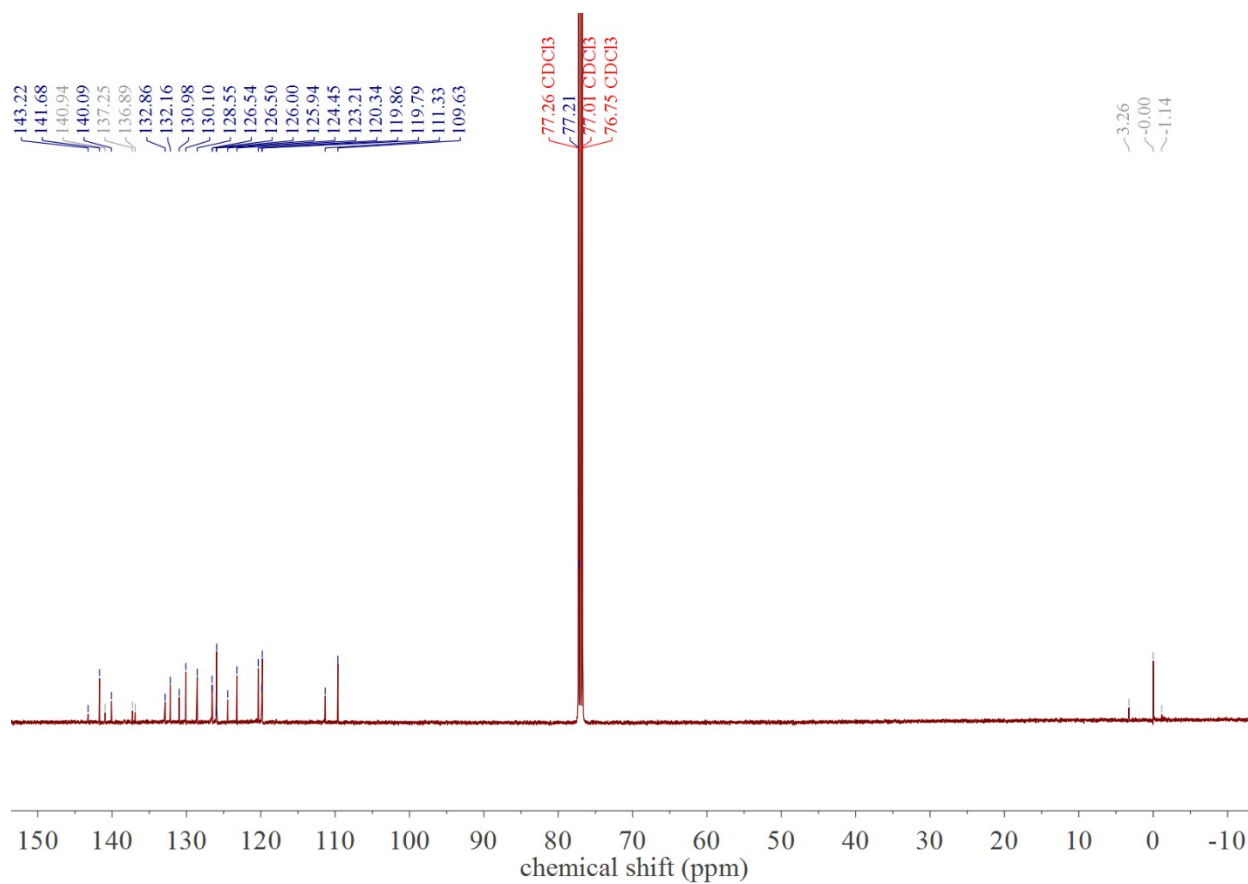


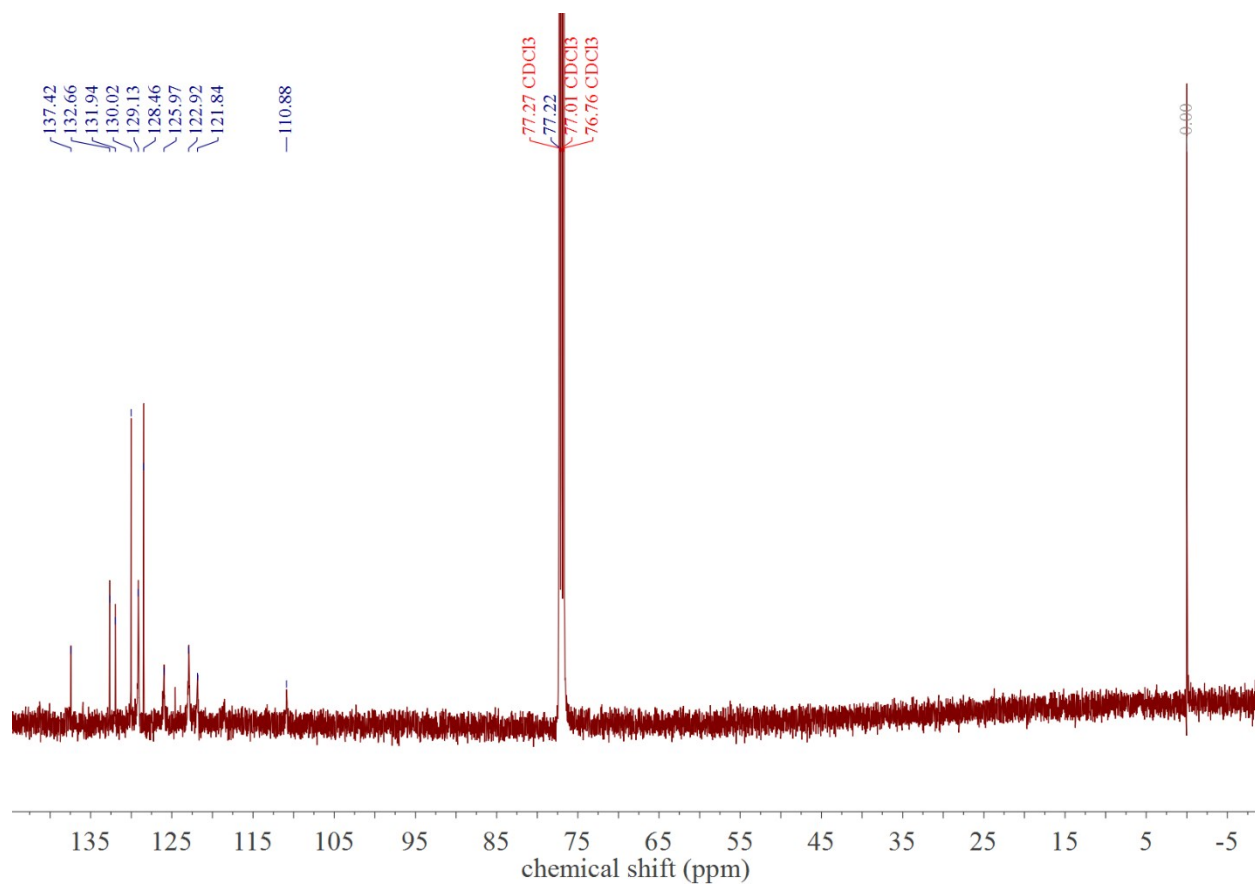
Fig. S8 <sup>1</sup>H NMR spectrum of CCDC in deuterated CDCl<sub>3</sub>.







**Fig. S10**  $^{13}\text{C}$  NMR spectrum of CCDC in deuterated  $\text{CDCl}_3$ .



**Fig. S11**  $^{13}\text{C}$  NMR spectrum of CCDP in deuterated  $\text{CDCl}_3$ .

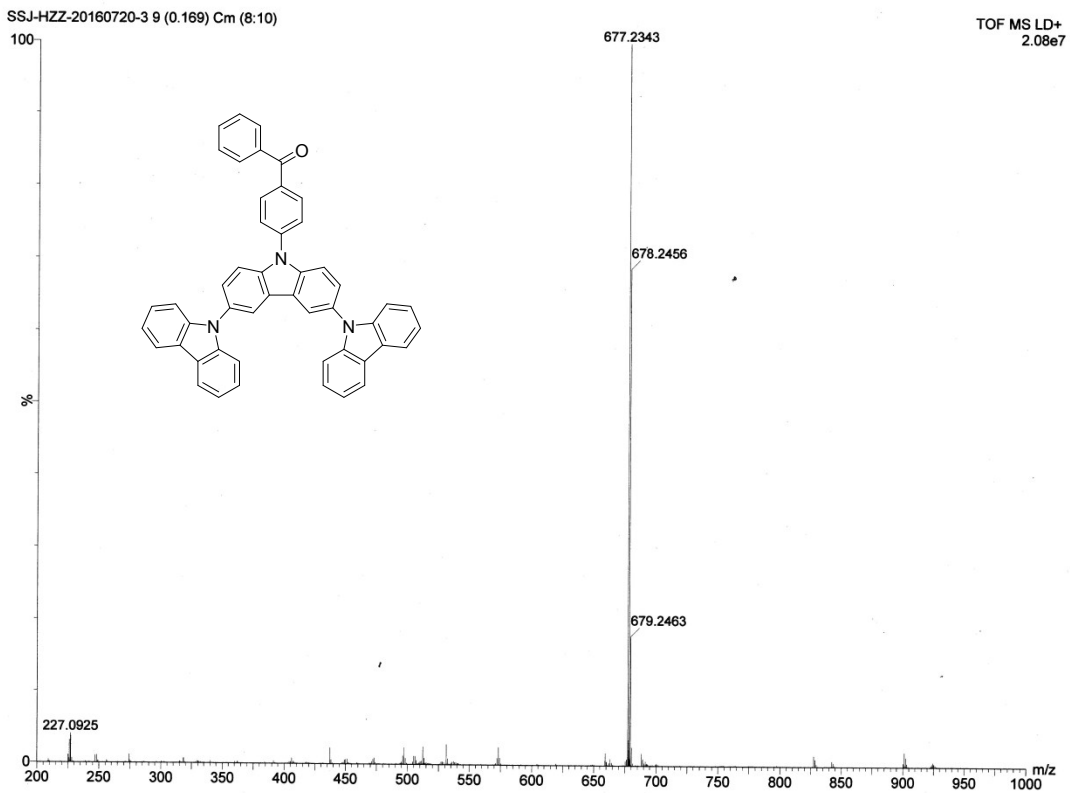


Fig. S12 MALDI-TOF spectrum of CCDC



Fig. S13 MALDI-TOF spectrum of CCDD