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Electronic Supplementary Information for

Thermally Activated Delayed Fluorescence Sensitizer for D-A-A Type Emitters with Orange-Red Light Emission

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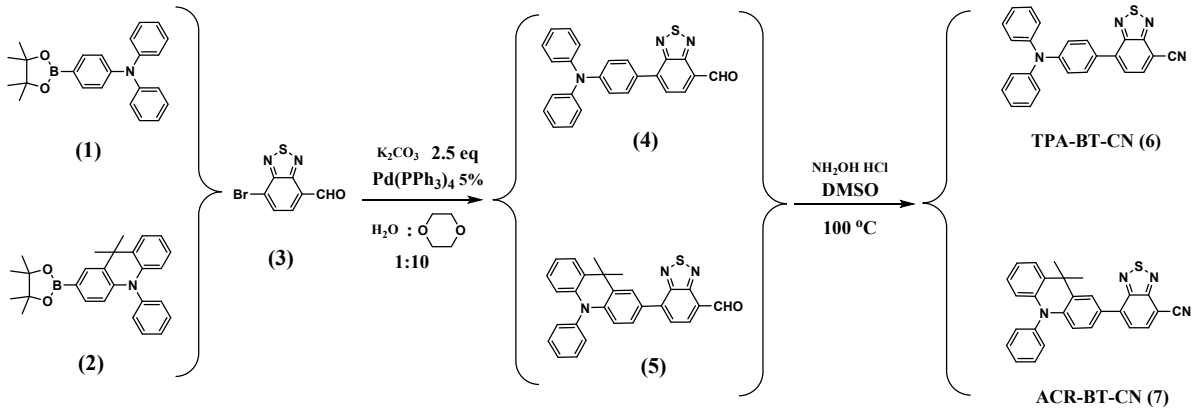
Table of Contents

Scheme S1. Synthetic routes of **TPA-BT-CN** and **ACR-BT-CN**.
Fig. S1. TGA and DSC curves of **TPA-BT-CN** and **ACR-BT-CN**.
Fig. S2. Absorption spectra of **TPA-BT-CN** and **ACR-BT-CN** in pure film state.
Fig. S3. Photoluminescence spectra of **TPA-BT-CN** and **ACR-BT-CN** in pure film state.
Fig. S4. Phosphorescent spectra of **TPA-BT-CN** and **ACR-BT-CN** in toluene at 77 K.
Fig. S5. Cyclic voltammetry curves of **TPA-BT-CN** and **ACR-BT-CN** recorded in DCM at room temperature.
Fig. S6. Energy level diagram of small molecules in the red OLED device.
Fig. S7. Chemical structures of functional materials related to the red OLED device.
Fig. S8. EQE-L characteristics of **ACR-BT-CN** and **TPA-BT-CN** under different doping ratios.
Fig. S9. EQE-L characteristics of **ACR-BT-CN** and **TPA-BT-CN** under different current densities.
Table S1. Photophysical data of **TPA-BT-CN** and **ACR-BT-CN**.
X-Ray Crystal Structure of **TPA-BT-CN** and **ACR-BT-CN.**



Scheme S1. Synthetic routes of **TPA-BT-CN** and **ACR-BT-CN.**

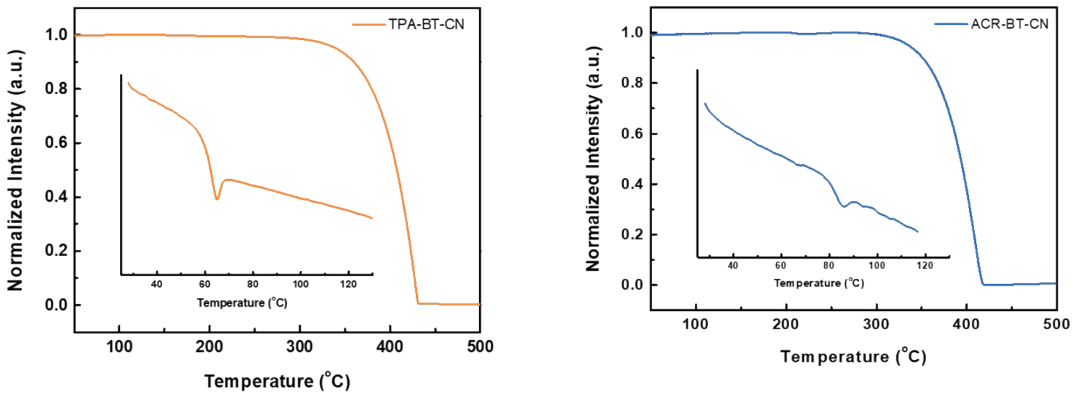


Fig. S1. TGA and DSC (inset figure) curves of **TPA-BT-CN** and **ACR-BT-CN**.

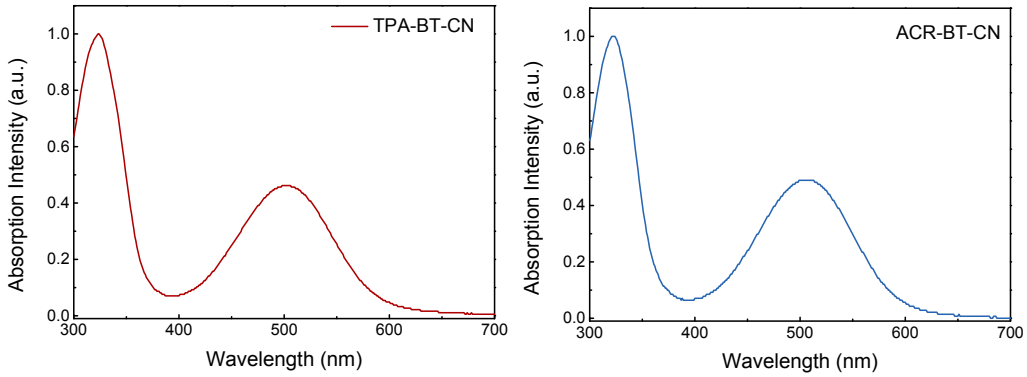


Fig. S2. Absorption spectra of **TPA-BT-CN** and **ACR-BT-CN** in pure film.

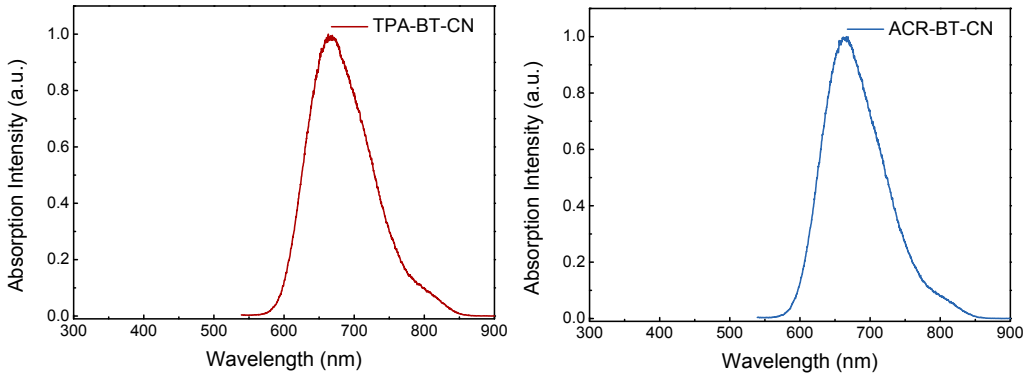


Fig. S3. Photoluminescence spectra of **TPA-BT-CN** and **ACR-BT-CN** in pure film.

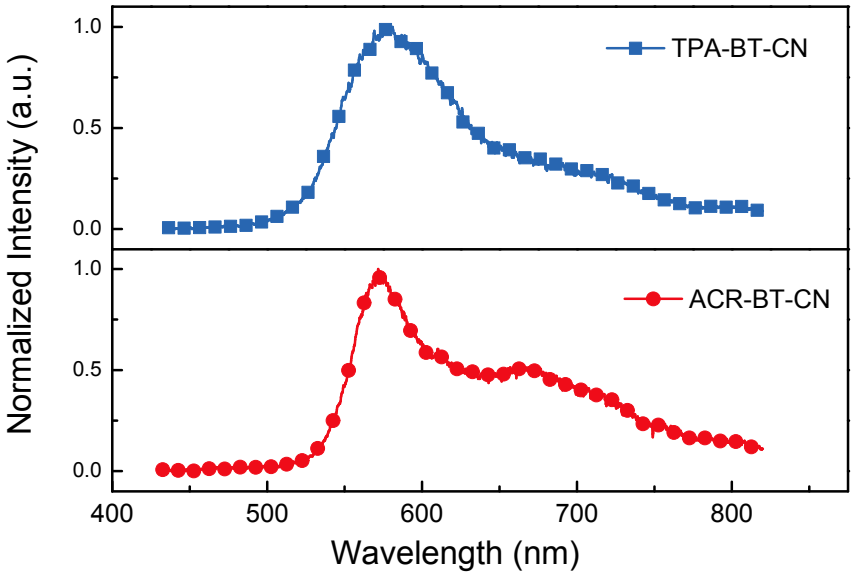


Fig. S4. Phosphorescent spectra of **TPA-BT-CN** and **ACR-BT-CN** in toluene at 77 K.

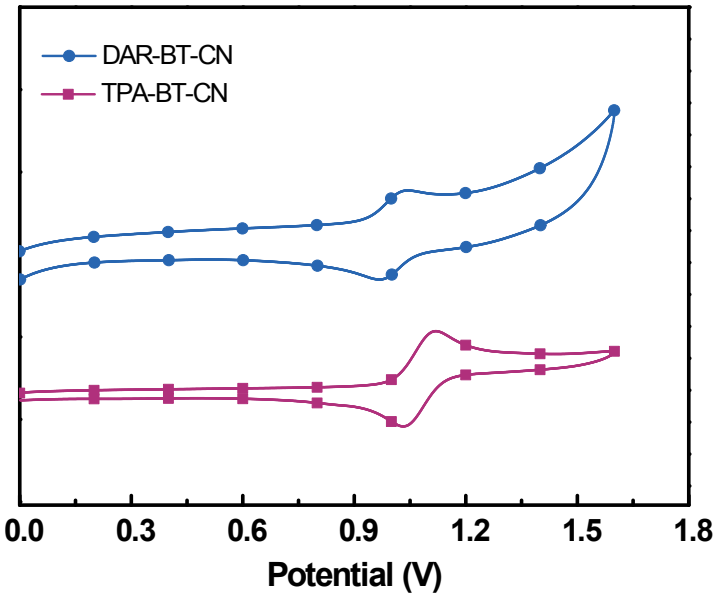


Fig. S5. Cyclic voltammetry curves of **TPA-BT-CN** and **ACR-BT-CN** recorded in DCM at room temperature.

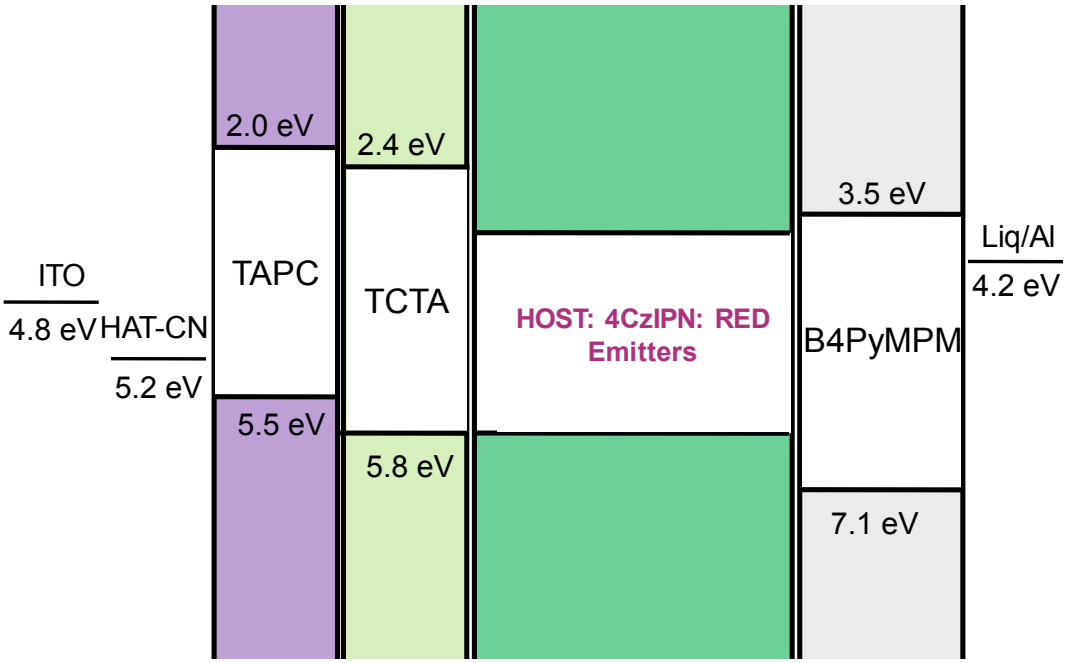


Fig. S6. Energy level diagram of small molecules in the red OLED device.

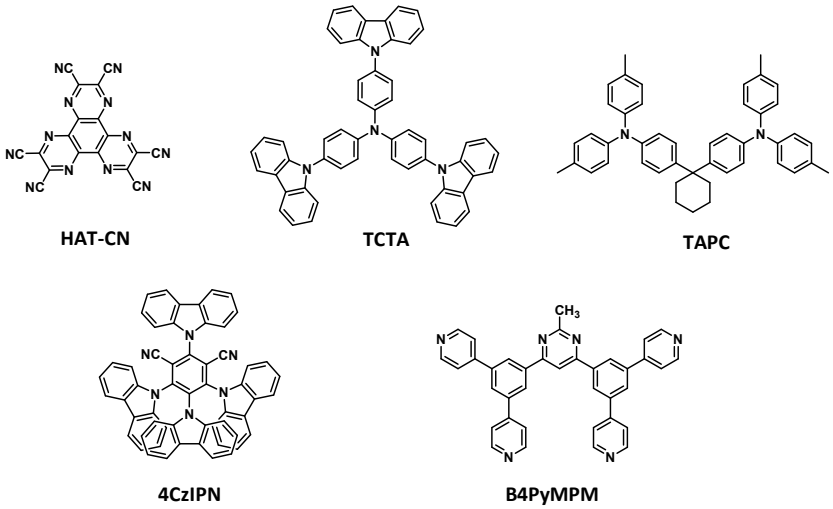


Fig. S7. Chemical structures of functional materials related to the red OLED device.

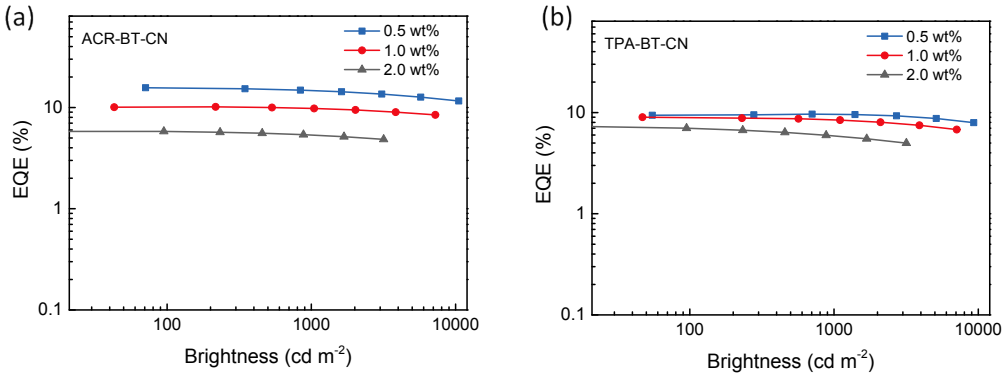


Fig. S8. EQE-L characteristics of **ACR-BT-CN** and **TPA-BT-CN** under different doping ratios.

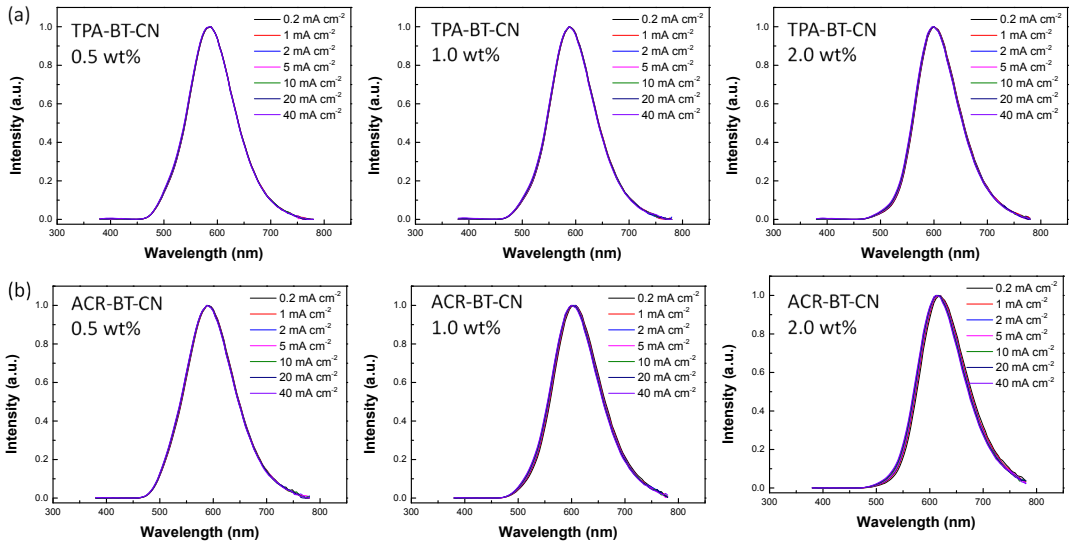


Fig. S9. EQE-L characteristics of **ACR-BT-CN** and **TPA-BT-CN** under different current densities.

Table S1. Photophysical properties of **TPA-BT-CN** and **ACR-BT-CN**.

Compound	Abs λ_{max}[a]	PL λ_{max}[a]	T_g[b]	T_d[c]	E_g[d]	HOMO[e]	LUMO[f]	PLQY[g]
	[nm]	[nm]	[°C]	[°C]	[eV]	[eV]	[eV]	[%]
TPA-BT-CN	477/505	667	65	336	2.09	-5.32	-3.23	76[g]
ACR-BT-CN	483/511	669	86	338	2.06	-5.22	-3.16	84[g]

(a) Tested in CH_2Cl_2 solution at room temperature (b)Glass transition temperature (c) Decomposition temperature (d) Bandgap energies calculated from the absorption edge in dilute CH_2Cl_2 solution (1×10^{-5} Mol L^{-1}) (e)HOMO energies: Calculated form the onset of oxidation peak recorded by the cyclic voltammetry (f)LUMO energies: Speculated from the HOMO energy and band gap (g) PLQY tested in mCP doped film.

X-Ray Crystal Structure Analysis

Crystallographic data have been deposited with the Cambridge Crystallographic Data Center as supplementary publication no. CCDC-1828815 (**TPA-BT-CN** (needle)), CCDC-1828816 (**ACR-BT-CN (**needle)). These data can beobtained free of charge from The Cambridge Crystallographic Data Centre *via* https://www.ccdc.cam.ac.uk/structures-beta/.

Datablock: TPA-BT-CN

```
Bond precision:  C-C = 0.0035 A          Wavelength=0.71073

Cell:            a=15.987(3)    b=11.2031(19)       c=11.3627(17)
                 alpha=90       beta=100.358(5)     gamma=90
Temperature:     296 K

                 Calculated                 Reported
Volume           2001.9(6)                  2001.9(6)
Space group      P 21/c                     P2(1)/c
Hall group       -P 2ybc                    ?
Moiety formula   C25 H16 N4 S               ?
Sum formula      C25 H16 N4 S               C25 H16 N4 S
Mr               404.48                     404.48
Dx,g cm-3        1.342                      1.342
Z                4                          4
Mu (mm-1)        0.181                      0.181
F000             840.0                      840.0
F000'            840.76
h,k,lmax         20,14,14                   19,13,12
Nref             4310                       3531
Tmin,Tmax        0.927,0.951
Tmin'            0.922

Correction method= Not given

Data completeness= 0.819          Theta(max)= 26.850

R(reflections)= 0.0454( 2560)     wR2(reflections)= 0.1410( 3531)

S = 1.011                 Npar= 271
```

Datablock: ACR-BT-CN

```
Bond precision:  C-C = 0.0043 A          Wavelength=0.71073

Cell:            a=36.066(11)     b=7.737(2)          c=16.095(4)
                 alpha=90         beta=91.584(9)      gamma=90
Temperature:     296 K

                Calculated                Reported
Volume          4490(2)                   4489(2)
Space group     C 2/c                     C2/c
Hall group      -C 2yc                    ?
Moiety formula  C28 H20 N4 S              ?
Sum formula     C28 H20 N4 S              C28 H20 N4 S
Mr              444.54                    444.54
Dx,g cm-3       1.315                     1.315
Z               8                         8
Mu (mm-1)       0.168                     0.168
F000            1856.0                    1856.0
F000'           1857.57
h,k,lmax        43,9,19                   43,9,19
Nref            4182                      3858
Tmin,Tmax       0.957,0.970               0.957,0.970
Tmin'           0.943

Correction method= # Reported T Limits: Tmin=0.957 Tmax=0.970
AbsCorr = ?

Data completeness= 0.923          Theta(max)= 25.500

R(reflections)= 0.0613( 2383)     wR2(reflections)= 0.1706( 3858)

S = 1.030                 Npar= 298
```