

# ELECTRONIC SUPPLEMENTARY INFORMATION

## Solution-processed OLED based on a mixed-ligand europium complex

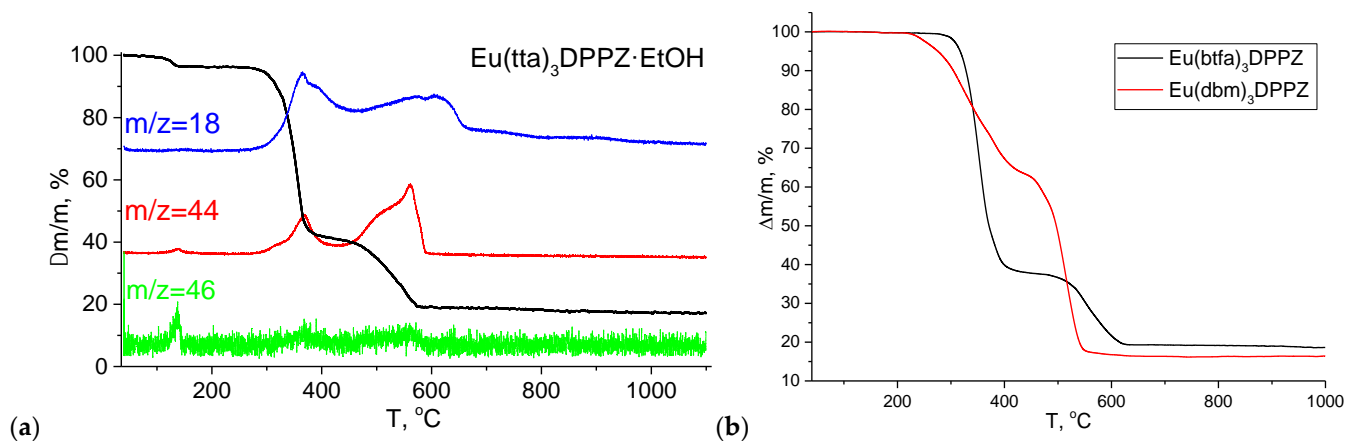
Makarii I. Kozlov,<sup>1</sup> Kirill M. Kuznetsov,<sup>1</sup> Alexander S. Goloveshkin,<sup>2</sup> Andrei Burlakin,<sup>3</sup> Maria Sandzhieva,<sup>3</sup> Sergey V. Makarov,<sup>3,4,5</sup> Elena Ilina,<sup>6</sup> and Valentina V. Utochnikova<sup>1,\*</sup>

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## 1. TGA data

The TGA data revealed that only  $\text{Eu}(\text{tta})_3\text{DPPZ}\cdot\text{EtOH}$  contained solvent molecules, which is eliminated in the range of 120–130°C, which results in the formation of  $\text{Eu}(\text{tta})_3\text{DPPZ}$ . Thermal decomposition of the rest of the complexes begins in the range of 280–290°C which occurs in two stages; the final weight loss corresponds to the formation of a mixture of  $\text{Eu}_2\text{O}_3$  and  $\text{EuOF}$  from  $\text{Eu}(\text{tta})_3\text{DPPZ}$ , which witnesses the correctness of the ascribed composition.

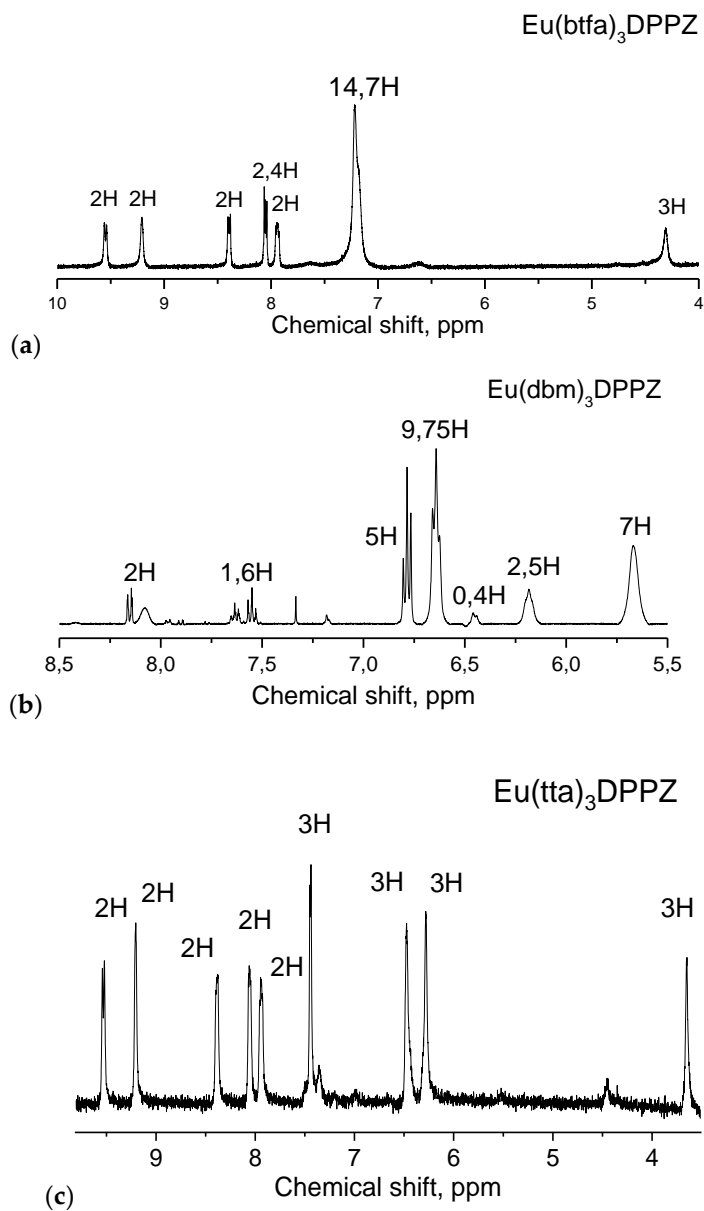
The presence of coordinated solvent molecules was confirmed by IR-spectroscopy. In the spectrum of  $\text{Eu}(\text{tta})_3\text{DPPZ}\cdot\text{EtOH}$  (Fig.S1b), low intensity bands at 3100–2800  $\text{cm}^{-1}$  are observed, corresponding to the aromatic and methane C–H vibrations of DPPZ and  $\text{tta}^-$ , bands at 1750–1150  $\text{cm}^{-1}$ , corresponding to C=O vibrations in  $\text{tta}^-$ , and bands at 850–515  $\text{cm}^{-1}$  corresponding to the C–F vibrations, which are also present in the anionic ligand. The presence of the low intense broad band at ca. 3400  $\text{cm}^{-1}$ , corresponding to the vibrations of the O–H bond, witnesses the presence of coordinated ethanol molecule.



**Figure S1.** (a) TGA curve of  $\text{Eu}(\text{tta})_3\text{DPPZ}\cdot\text{EtOH}$ . Normalized ionic currents are shown in blue ( $m/z = 18$ ), red ( $m/z = 44$ ), and green ( $m/z = 46$ ). (b) IR-spectrum of  $\text{Eu}(\text{tta})_3\text{DPPZ}\cdot\text{EtOH}$ . b) TGA curves of  $\text{Eu}(\text{btfa})_3\text{DPPZ}$  and  $\text{Eu}(\text{dbm})_3\text{DPPZ}$

## 2. $^1\text{H}$ NMR spectroscopy

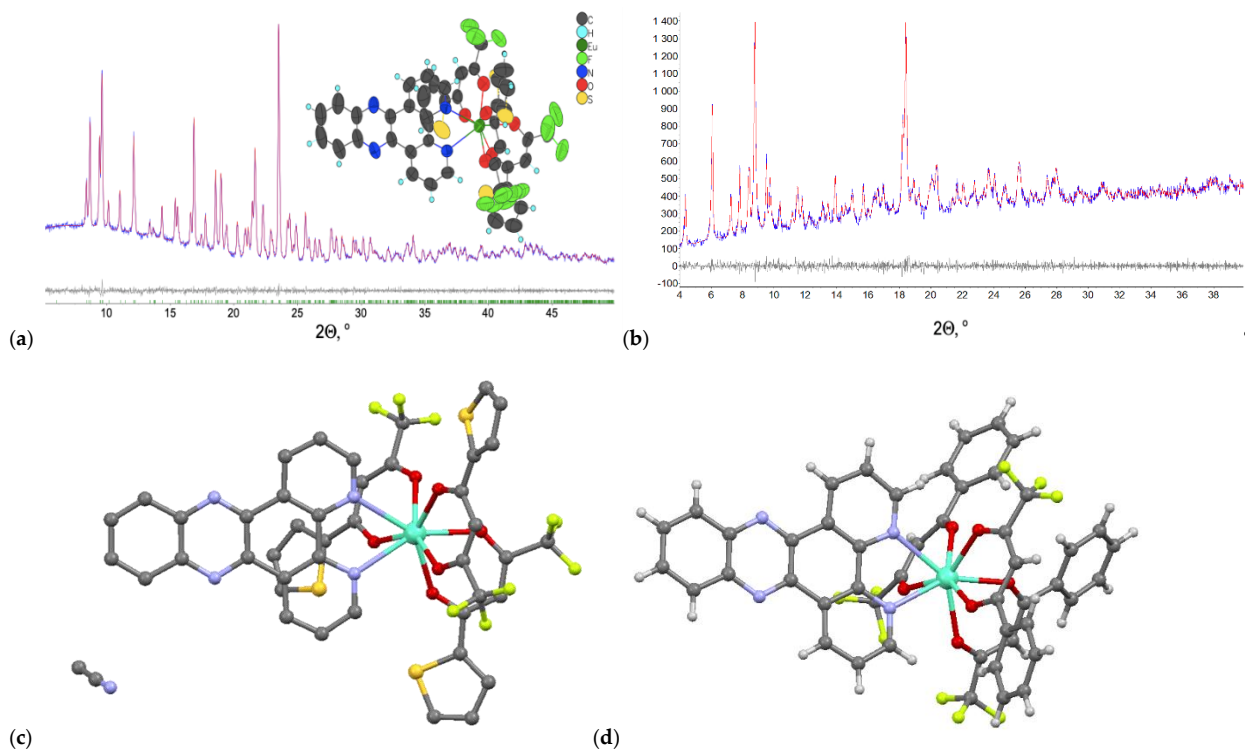
In order to confirm the ratio of the neutral ligand DPPZ and the anionic ligand in compound,  $^1\text{H}$  NMR spectra were studied. Owing to the effect of a paramagnetic  $\text{Eu}^{3+}$  ion, broadening and a shift of proton signals are observed in the  $^1\text{H}$  NMR spectra. The comparison of  $^1\text{H}$  NMR spectra shows that total integrated intensity is equal to three anionic ligands per each neutral ligand. This confirms the composition of  $\text{Eu}(\text{dik})_3\text{DPPZ}$  ( $\text{dik} = \text{tta}, \text{btfa}, \text{dbm}$ ).



**Figure S2.** The  $^1\text{H}$  NMR spectra of (a)  $\text{Eu}(\text{btfa})_3\text{DPPZ}$ , (b)  $\text{Eu}(\text{dbm})_3\text{DPPZ}$ , and (c)  $\text{Eu}(\text{tta})_3\text{DPPZ}$  in  $\text{DMSO}-d_6$  solution.

### 3. XRD data

Powder pattern of  $\text{Eu}(\text{tta})_3\text{DPPZ}\cdot\text{EtOH}$  was successfully Rietveld refined using the  $[\text{Eu}(\text{tta})_3\text{DPPZ}]\cdot\text{MeCN}$  structure (CCDC 2072867). Only the cell parameters were optimized, the atomic coordinates were taken from the structure of the single crystal and were not refined.

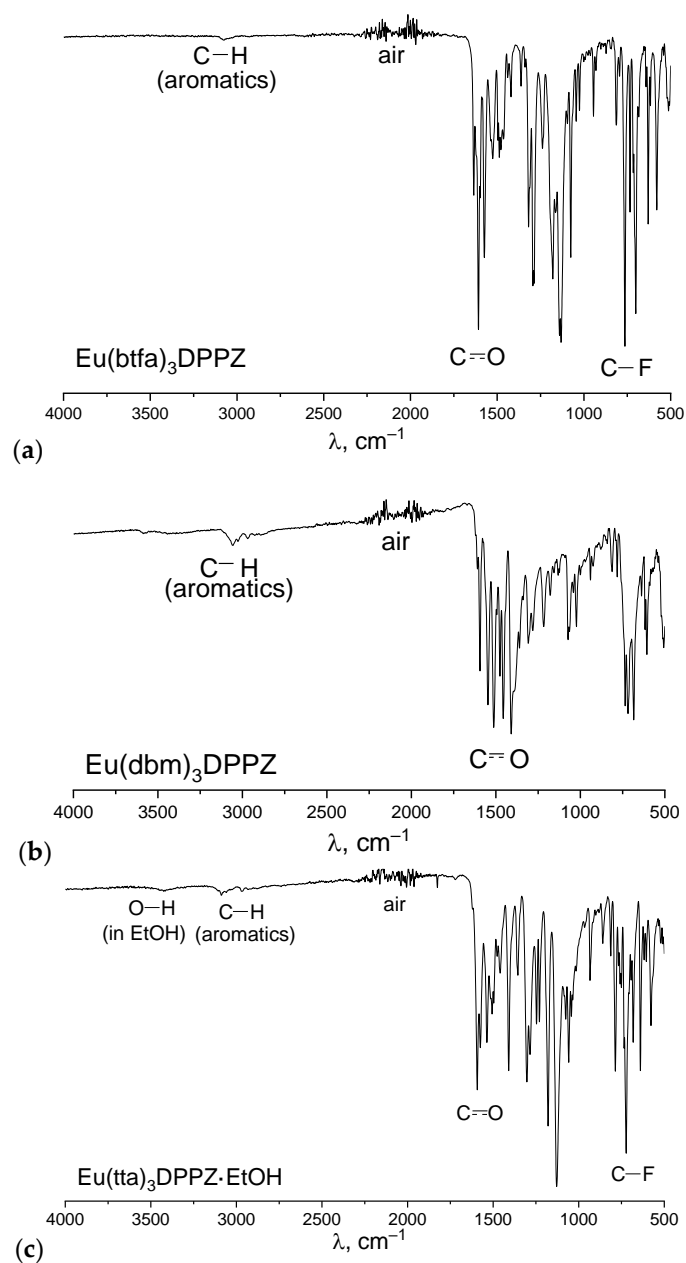


**Figure S3.** (a) Indexed PXRD pattern of  $\text{Eu}(\text{tta})_3\text{DPPZ}\cdot\text{EtOH}$ , (b) Pawley fit (red line) of  $\text{Eu}(\text{dbm})_3\text{DPPZ}$  (blue line) and their difference (grey curve). Molecules in the structures of (c)  $\text{Eu}(\text{tta})_3\text{DPPZ}$  and (d)  $\text{Eu}(\text{btfa})_3\text{DPPZ}$ .

Obtained pattern of  $\text{Eu}(\text{dbm})_3\text{DPPZ}$  was successfully Pawley fitted with monoclinic cell based on  $\text{Dy}(\text{dbm})_3\text{DPPZ}$  structure (CCDC 1062453). The cell parameters after refinement are following:

R-Bragg	0.175
Spacegroup	$P21/c$
Cell Volume ( $\text{\AA}^3$ )	10257(9)
Lattice parameters	
a ( $\text{\AA}$ )	12.289(7)
b ( $\text{\AA}$ )	20.829(10)
c ( $\text{\AA}$ )	40.716(19)
beta ( $^\circ$ )	100.20(4)

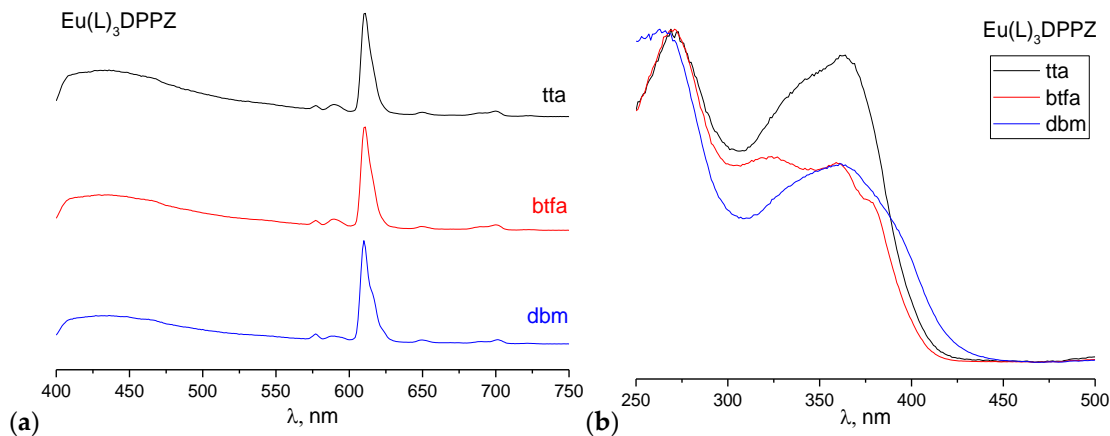
#### 4. IR spectroscopy



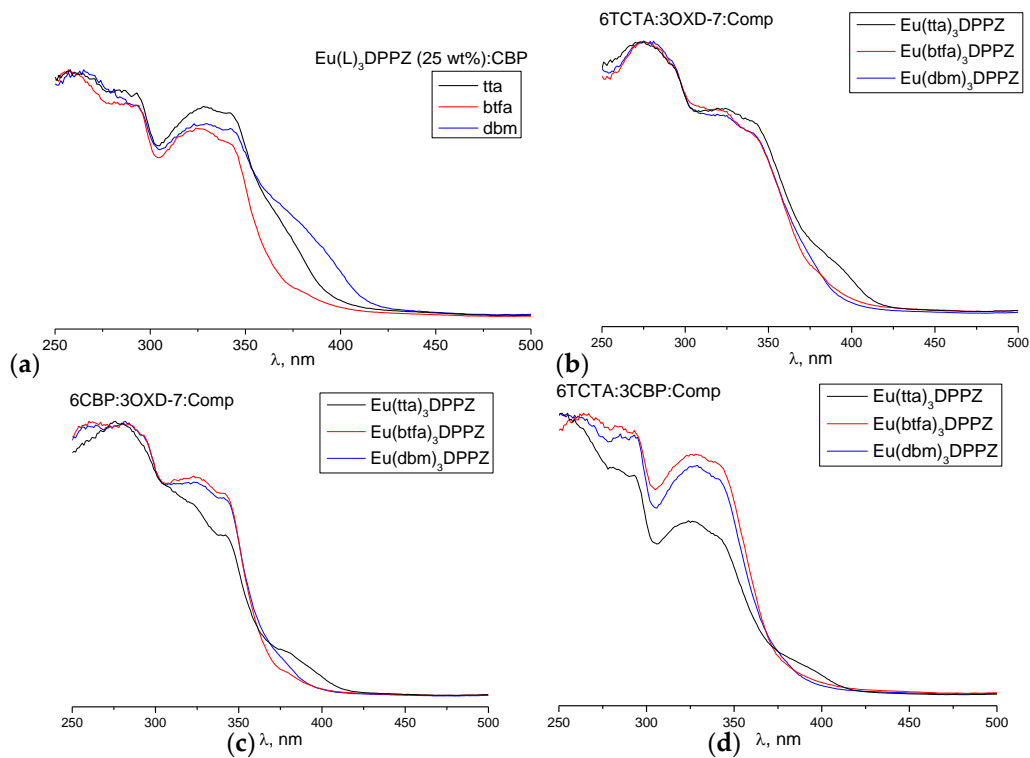
**Figure S4.** IR spectra of (a)  $\text{Eu}(\text{btfa})_3\text{DPPZ}$ , (b)  $\text{Eu}(\text{dbm})_3\text{DPPZ}$ , and (c)  $\text{Eu}(\text{tta})_3\text{DPPZ} \cdot \text{EtOH}$ .

## 5. Photoluminescence properties of thin films

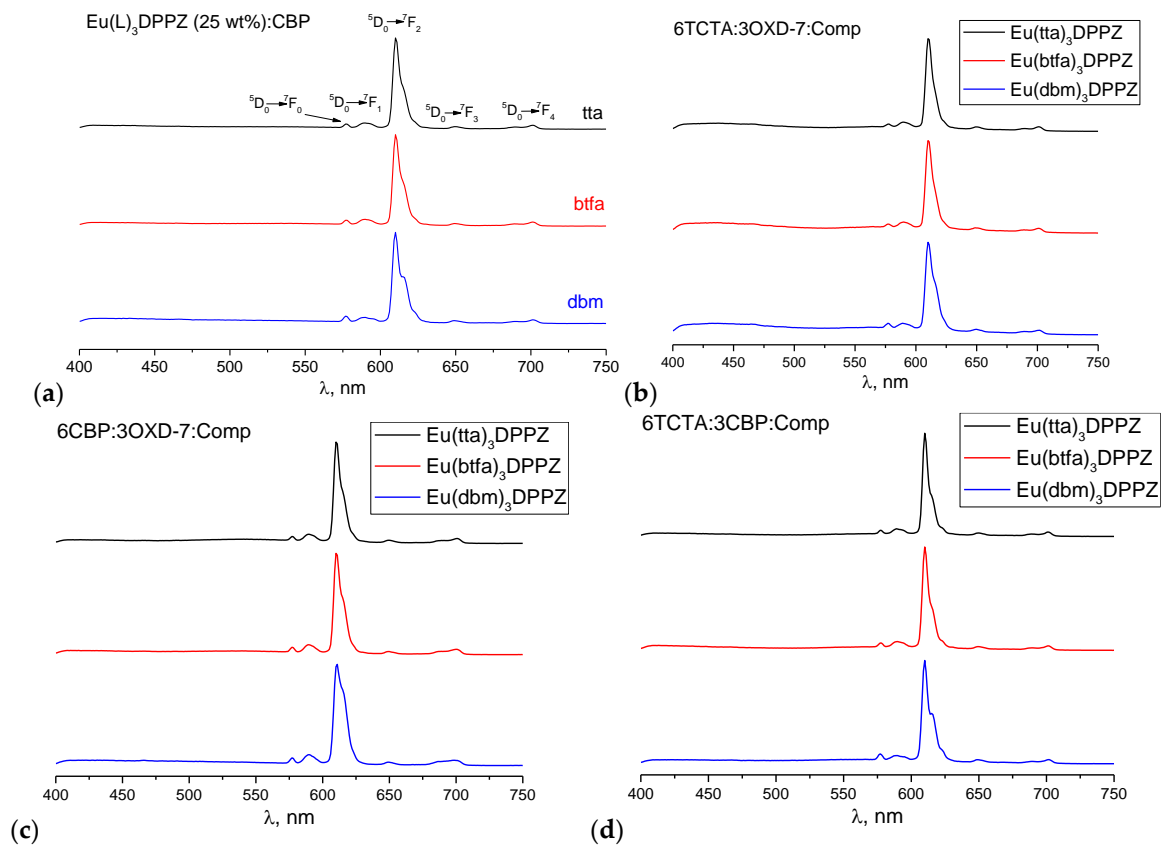
We studied photoluminescent properties of pure and composite films, deposited from a 200  $\mu\text{L}$  of the complex and the host solution (5  $\text{g L}^{-1}$  concentration) at 1500 rpm for 1 min and heated at 80  $^{\circ}\text{C}$  for 20 min. After that solution-processed OLEDs were obtained with composite films used as EML.



**Figure S5.** (a) Luminescence and (b) excitation spectra of pure thin films.

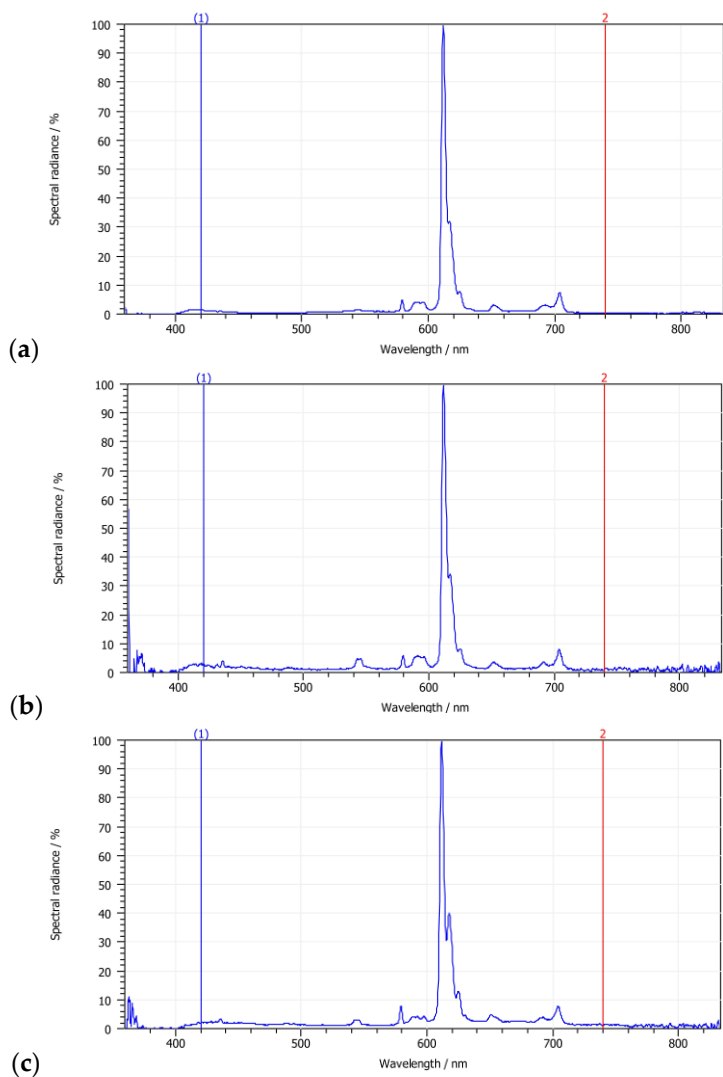


**Figure S6.** Excitation spectra of composite thin films of (a) CBP:complex = 1:3, (b) TCTA:OXD-7:complex = 6:3:1, (c) CBP:OXD-7:complex = 6:3:1, (d) TCTA:CBP:complex = 6:3:1.



**Figure S7.** Luminescence spectra of composite thin films of (a) CBP:complex = 1:3, (b) TCTA:OXD-7:complex = 6:3:1, (c) CBP:OXD-7:complex = 6:3:1, (d) TCTA:CBP:complex = 6:3:1.

## 6. Electroluminescence properties of thin films



**Figure S8.** Electroluminescence spectra of OLEDs (a) S1, (b) S2, and (c) S3.