A single component white electroluminescent device fabricated from a metallo-organic terbium complex

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Supporting Information (SI)

Contents

Synthesis of [Ln(tfac)$_3$(H$_2$O)$_2$] (Ln: Eu and Tb)

Binary hydrated [Ln(tfac)$_3$(H$_2$O)$_2$] complexes (**Chart S1**) were synthesized by the method reported by one us; instead of acetylacetone, hemi-fluorinated Htfac was used. Briefly, LnCl$_3$.6H$_2$O (Eu- 2.39 g, 6.57 mmol; Tb- 2.40 g, 6.57 mmol) aqueous solution was added dropwise through a dropping funnel to a solution of ammonium salt of tfac (2.0 g, 19.97 mmol). The white precipitate formed was filtered, washed with copious amount of deionized water and dried in vacuum over P$_4$O$_{10}$.

[Eu(tfaa)$_3$(H$_2$O)$_2$] Calculated for C$_{15}$H$_{16}$EuF$_9$O$_8$: C, 27.84; H, 2.49 found C, 27.50; H, 2.35; FT-IR (solid;cm^{-1}) - ν(O-H) ~ 3,209 – 3,503(b); ν(C=O) ~ 1,613(s); ν(C=C) ~ 1,532(m)

[Tb(tfaa)$_3$(H$_2$O)$_2$] Calculated for C$_{15}$H$_{16}$TbF$_9$O$_8$: C, 27.54; H, 2.47 found C, 27.40; H, 2.20; FT-IR (solid;cm^{-1})) - ν(O-H) ~ 3,209 – 3,503(b); ν(C=O) ~ 1,614(s); ν(C=C) ~ 1,531(m).

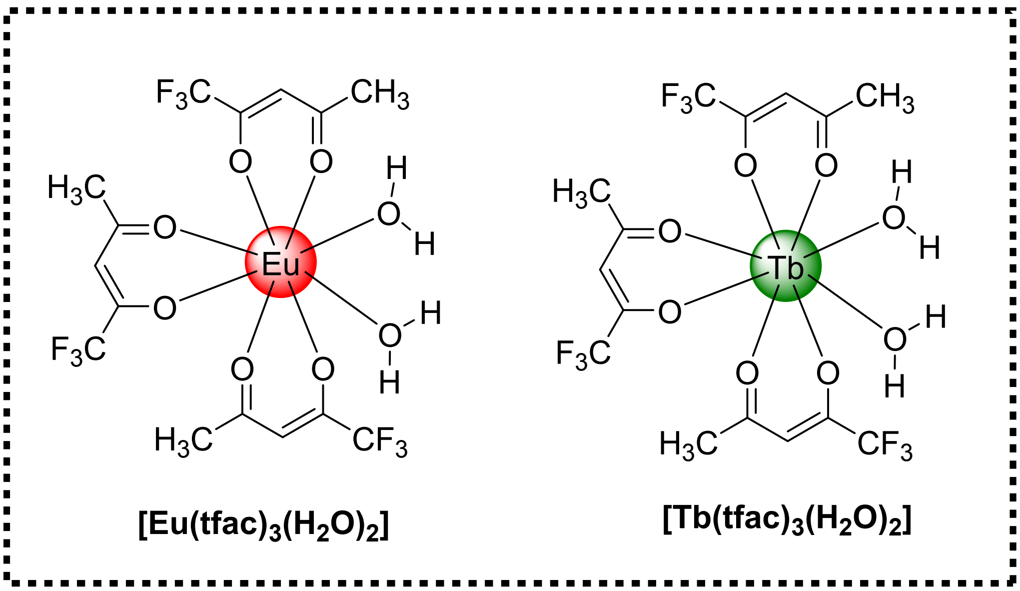

Chart S1: Chemical structures of binary hydrated [Ln(tfac)$_3$(H$_2$O)$_2$] complexes.

Molecular Structure Determination by Single-Crystal X-ray Crystallography

For each of the two structures [Ln(tfac)$_3$(DPEPO)] (Ln: Eu(**Eu-1**) and Tb(**Tb-2**)) the crystals were cooled to 150 K using an Oxford Diffraction Cryojet low-temperature apparatus. The data reduction including an empirical absorption correction using the SCALE3 ABSPACK scaling algorithm was performed using the CrysAlisPro software package.[1] The crystal structures were solved by direct methods using SIR-97,[2] and refined using SHELXTL[3] within the OLEX2[4] software package. The non-hydrogen atoms were refined anisotropically. The hydrogen atoms were placed in idealized positions and refined with a riding model, with $U_{iso}(H) = 1.2\ U_{eq}(C,N)$. In each structure one of the CF_3 groups was severely disordered. The group was modelled as two, partial occupancy CF_3 groups with a common C atom, and refined so that the occupancy of the two disordered components summed to unity. The structures were refined to convergence.

Determination of photoluminescence quantum yield (PLQY) of Tb-2.

The absolute PLQY of **Tb-2** in the solid-state and in DCM solution were determined by using a calibrated integrating sphere on a C-9920-02 instrument. The excitation wavelength was 335 nm and the data were measured within the range 450-700 nm. For solid-state measurements, the powder was pressed directly while for the DCM solution 10 mg of **Tb-2** was dissolved in 1 mL of DCM.

Table S 1. Crystal data and structure refinement for **Eu-1** and **Tb-2** complexes.

Identification code	Eu-1	Tb-2
CCDC number	1942486	1942487
Empirical formula	$C_{51}H_{40}EuF_9O_9P_2$	$C_{51}H_{40}TbF_9O_9P_2$
Formula weight	1181.73	1188.69
Temperature/K	150.00(10)	149.6(9)
Crystal system	triclinic	triclinic
Space group	P-1	P-1
a/Å	12.9046(3)	12.9304(3)
b/Å	13.7184(3)	13.7121(3)
c/Å	16.8199(4)	16.7959(4)
α/°	94.511(2)	94.449(2)
β/°	110.592(2)	110.577(2)
γ/°	110.126(2)	110.301(2)
Volume/Å^3	2548.76(11)	2546.39(11)
Z	2	2
ρ_{calc}g/cm^3	1.540	1.550
μ/mm^{-1}	1.380	1.538
F(000)	1184.0	1188.0
Crystal size/mm^3	0.4 × 0.3 × 0.3	0.3 × 0.3 × 0.3
Radiation	MoKα (λ = 0.71073)	MoKα (λ = 0.71073)
2Θ range for data collection/°	8.38 to 54.968	8.384 to 54.968
Index ranges	-16 ≤ h ≤ 16, -17 ≤ k ≤ 17, -21 ≤ l ≤ 21	-16 ≤ h ≤ 16, -17 ≤ k ≤ 17, -21 ≤ l ≤ 21
Reflections collected	55605	40032
Independent reflections	11495 [R_{int} = 0.0514, R_{sigma} = 0.0403]	11461 [R_{int} = 0.0521, R_{sigma} = 0.0510]
Data/restraints/parameters	11495/36/680	11461/36/680
Goodness-of-fit on F^2	1.073	1.026
Final R indexes [I>=2σ (I)]	R_1 = 0.0314, wR_2 = 0.0668	R_1 = 0.0348, wR_2 = 0.0765
Final R indexes [all data]	R1 = 0.0408, wR_2 = 0.0715	R_1 = 0.0458, wR_2 = 0.0818
Largest diff. peak/hole / e Å^{-3}	1.27/-0.71	1.32/-1.13

Table S 2 . Fractional Atomic Coordinates (×10^4) and Equivalent Isotropic Displacement Parameters (Å^2×10^3) for **Eu-1**. U_{eq} is defined as 1/3 of the trace of the orthogonalised U_{IJ} tensor.

Atom	*x*	*y*	*z*	U(eq)
Eu1	950.3(2)	2220.0(2)	2215.4(2)	20.36(5)
P1	1910.8(6)	5200.1(5)	2372.8(4)	22.45(14)
P2	-1940.2(6)	2611.1(6)	2012.8(4)	23.98(15)
F1	3374(12)	1514(6)	207(14)	116(6)
F2	4226(5)	2850(13)	1236(5)	87(4)
F3	3311(9)	2969(13)	-4(10)	110(5)
F1A	3868(10)	1929(16)	1093(8)	109(4)
F2A	3745(15)	3260(7)	642(15)	138(7)
F3A	3031(8)	1806(14)	-213(6)	109(5)
F4	2535(2)	-448(2)	4200.7(17)	85.3(9)
F5	2836(2)	-718(2)	3041.8(17)	74.0(7)
F6	3723(2)	814.0(19)	3884.4(15)	61.4(6)
F7	1993(2)	1875(3)	5744.2(16)	111.3(13)
F8	631(3)	2447(2)	5176.7(16)	78.5(8)
F9	370(2)	899.1(19)	4651.5(15)	70.3(7)
O1	1447.4(16)	4016.3(14)	2110.2(11)	23.7(4)
O2	-746.5(17)	2574.7(15)	2166.9(12)	26.2(4)
O3	-686.4(17)	4564.7(15)	1601.2(12)	27.5(4)
O4	-280.1(17)	1486.9(15)	685.0(12)	27.1(4)
O5	2200.9(18)	2424.2(16)	1428.5(13)	31.3(4)
O6	-566.5(18)	487.0(15)	2048.3(12)	30.7(4)
O7	1908.6(18)	1028.5(15)	2670.8(12)	28.9(4)
O8	2981.5(18)	3258.7(16)	3318.6(13)	32.3(5)
O9	950.9(17)	2217.6(15)	3626.2(11)	27.8(4)
C1	-161(3)	1220(2)	2.9(17)	29.1(6)
C2	976(3)	1454(3)	-32.5(19)	36.5(7)
C3	2039(3)	2040(2)	669.1(19)	31.6(6)
C4	-1272(3)	670(3)	-828.5(19)	39.6(8)
C5	3203(4)	2306(4)	525(3)	51.5(9)
C6	-564(3)	-261(2)	2430.3(19)	34.2(7)
C7	492(3)	-388(2)	2948(2)	37.3(7)
C8	1622(3)	253(2)	3016.4(18)	31.7(7)
C9	-1764(3)	-1069(3)	2335(2)	50.2(9)
C10	2677(3)	-22(3)	3541(2)	43.5(8)
C11	3547(3)	3220(3)	4077(2)	37.8(7)
C12	2979(3)	2757(3)	4625(2)	41.3(8)
C13	1762(3)	2316(2)	4359.9(18)	32.5(7)

C14	4911(3)	3692(4)	4428(3)	62.4(11)
C15	1226(3)	1880(3)	4995(2)	47.2(9)
C16	3455(3)	5802(2)	2517.0(19)	30.1(6)
C17	3900(3)	5162(3)	2185(2)	39.3(7)
C18	5050(3)	5599(3)	2191(3)	53.7(10)
C19	5740(3)	6675(3)	2534(3)	55.1(10)
C20	5318(3)	7314(3)	2876(2)	50.6(9)
C21	4180(3)	6885(3)	2875(2)	41.2(8)
C22	1111(2)	5739(2)	1533.6(16)	23.2(5)
C23	1671(3)	6446(2)	1111.2(18)	27.8(6)
C24	987(3)	6741(2)	409.9(18)	31.3(6)
C25	-254(3)	6344(2)	129.8(18)	32.6(7)
C26	-825(3)	5650(2)	541.3(18)	30.0(6)
C27	-134(3)	5352(2)	1235.3(17)	24.9(6)
C28	1758(3)	5644(2)	3345.2(17)	27.7(6)
C29	1894(3)	6686(2)	3597(2)	38.3(7)
C30	1750(4)	6998(3)	4341(2)	48.4(9)
C31	1451(4)	6270(3)	4826(2)	49.3(9)
C32	1297(3)	5232(3)	4574(2)	45.3(8)
C33	1464(3)	4917(2)	3839.5(19)	34.2(7)
C34	-1221(3)	4793(2)	2123.1(17)	27.5(6)
C35	-1126(3)	5811(3)	2396.9(19)	35.5(7)
C36	-1672(3)	5960(3)	2942(2)	44.6(8)
C37	-2301(3)	5126(3)	3212(2)	46.8(9)
C38	-2394(3)	4106(3)	2939.2(19)	37.3(7)
C39	-1852(3)	3920(2)	2386.4(17)	27.2(6)
C40	-2962(2)	2167(2)	879.8(17)	27.9(6)
C41	-3585(3)	2746(3)	447(2)	37.3(7)
C42	-4367(3)	2345(3)	-432(2)	47.0(9)
C43	-4530(3)	1376(3)	-855(2)	46.9(9)
C44	-3925(3)	796(3)	-434(2)	46.8(9)
C45	-3130(3)	1192(3)	435(2)	38.2(7)
C46	-2689(3)	1752(2)	2574.6(18)	29.5(6)
C47	-3917(3)	1454(3)	2358(2)	44.9(8)
C48	-4461(3)	839(3)	2826(2)	54.8(10)
C49	-3789(4)	507(3)	3492(2)	52.2(10)
C50	-2581(4)	788(3)	3705(2)	46.0(9)
C51	-2015(3)	1415(2)	3245.0(19)	34.6(7)

Table S 3. Anisotropic Displacement Parameters (Å2×103) for **Eu-1**. The Anisotropic displacement factor exponent takes the form: 2π2[h2a*2U11+2hka*b*U12+…].

Atom	U_{11}	U_{22}	U_{33}	U_{23}	U_{13}	U_{12}
Eu1	24.16(7)	17.77(7)	17.76(7)	6.00(5)	8.28(5)	6.54(5)
P1	24.4(3)	17.7(3)	22.1(3)	7.0(3)	7.8(3)	5.8(3)
P2	23.1(3)	27.0(4)	22.0(3)	8.1(3)	10.7(3)	8.1(3)
F1	94(8)	57(4)	238(17)	-2(7)	122(10)	27(4)
F2	39(3)	145(11)	61(4)	-5(5)	27(3)	16(4)
F3	91(6)	163(12)	154(9)	126(9)	96(7)	71(7)
F1A	61(5)	188(13)	120(8)	60(8)	45(5)	81(7)
F2A	141(11)	67(5)	235(16)	-1(8)	165(13)	-10(6)
F3A	69(4)	206(15)	60(4)	-22(5)	39(3)	60(6)
F4	80.7(18)	130(2)	86.7(18)	87.0(18)	48.2(15)	61.8(18)
F5	83.8(18)	67.2(16)	89.2(18)	14.1(14)	31.7(15)	55.1(15)
F6	51.3(13)	59.3(15)	71.2(15)	24.8(12)	13.6(11)	28.6(12)
F7	72.2(18)	206(4)	48.0(14)	74.1(19)	18.3(13)	42(2)
F8	107(2)	86.7(19)	62.0(15)	13.3(14)	56.7(15)	39.7(17)
F9	98.5(19)	54.5(15)	57.9(14)	22.5(12)	46.0(14)	13.5(14)
O1	24.4(10)	19.2(9)	25.5(9)	7.5(8)	9.6(8)	6.5(8)
O2	27.4(10)	24.9(10)	26.7(10)	9.9(8)	11.6(8)	9.3(8)
O3	33.1(11)	22.2(10)	33(1)	10.9(8)	18.8(9)	11.0(9)
O4	33.4(11)	25.1(10)	21.5(9)	5.3(8)	11.3(8)	10.0(9)
O5	32.8(11)	32.6(11)	29.4(10)	7.6(9)	15.6(9)	10.8(9)
O6	34.1(11)	22.9(10)	26.9(10)	6.5(8)	10.1(9)	4.1(9)
O7	39.2(12)	22.5(10)	30.4(10)	10.1(8)	18.2(9)	13.2(9)
O8	30.2(11)	28.0(11)	29.6(11)	10.7(9)	5.9(9)	6.7(9)
O9	31.3(11)	28.9(11)	20.1(9)	6.3(8)	8.0(8)	10.7(9)
C1	45.4(18)	22.5(14)	22.8(13)	7.2(11)	13.2(13)	17.6(13)
C2	48.7(19)	43.6(19)	28.2(15)	8.3(13)	20.9(14)	25.3(16)
C3	42.2(17)	33.8(16)	35.7(16)	16.9(13)	24.0(14)	24.3(15)
C4	50(2)	37.1(18)	23.2(15)	1.0(13)	6.4(14)	18.1(16)
C5	50(2)	64(3)	50(2)	8.4(19)	29.6(19)	25(2)
C6	46.2(18)	21.9(15)	29.4(15)	3.8(12)	20.1(14)	3.3(14)
C7	54(2)	28.3(16)	37.0(17)	18.0(13)	24.1(15)	16.3(15)
C8	50.2(19)	26.1(15)	27.6(14)	10.2(12)	20.7(14)	19.1(14)
C9	52(2)	37(2)	51(2)	14.9(16)	24.7(18)	0.7(17)
C10	58(2)	41(2)	45.3(19)	23.8(16)	25.4(17)	27.9(18)
C11	33.4(17)	31.2(17)	32.5(16)	6.6(13)	1.7(13)	6.3(14)
C12	40.3(18)	47(2)	24.4(15)	11.6(14)	2.4(13)	13.8(16)
C13	46.3(18)	30.2(16)	19.7(13)	7.1(12)	10.8(13)	16.0(14)
C14	33.8(19)	74(3)	53(2)	18(2)	0.8(17)	8.4(19)

C15	55(2)	57(2)	26.3(16)	13.2(16)	15.3(16)	17.9(19)
C16	24.7(14)	27.8(15)	31.1(15)	11.4(12)	7.0(12)	6.3(12)
C17	28.6(16)	31.3(17)	53(2)	11.3(15)	16.6(15)	5.4(14)
C18	29.8(18)	51(2)	78(3)	14(2)	23.9(18)	11.3(17)
C19	25.9(17)	52(2)	76(3)	24(2)	17.1(18)	4.7(17)
C20	29.0(17)	35.5(19)	62(2)	16.9(17)	2.3(16)	-0.7(15)
C21	32.5(17)	29.1(17)	46.0(19)	7.8(14)	5.6(14)	4.6(14)
C22	32.1(15)	18.9(13)	18.7(12)	4.8(10)	9.6(11)	10.8(12)
C23	35.9(16)	22.3(14)	28.0(14)	8.6(11)	15.5(12)	11.6(13)
C24	48.7(19)	25.3(15)	28.3(14)	11.6(12)	20.9(14)	17.7(14)
C25	50.7(19)	27.1(16)	22.0(14)	7.4(12)	11.5(13)	20.3(15)
C26	33.4(16)	25.1(15)	28.4(14)	4.6(12)	7.9(12)	13.1(13)
C27	33.5(15)	18.3(13)	24.0(13)	5.9(11)	12.5(12)	10.4(12)
C28	31.0(15)	24.1(15)	21.5(13)	5.7(11)	6.4(11)	8.0(12)
C29	54(2)	26.9(16)	30.3(16)	6.6(13)	14.7(15)	13.4(15)
C30	76(3)	33.1(19)	31.5(17)	0.0(14)	17.6(17)	21.8(18)
C31	75(3)	50(2)	26.5(16)	5.2(15)	22.9(17)	27(2)
C32	65(2)	46(2)	29.6(16)	14.2(15)	23.0(16)	22.3(18)
C33	45.5(18)	27.1(16)	27.3(15)	7.8(12)	13.0(13)	12.8(14)
C34	30.0(15)	34.1(16)	22.9(13)	8.1(12)	10.5(11)	17.6(13)
C35	42.8(18)	31.8(17)	31.9(16)	7.1(13)	11.9(14)	18.3(15)
C36	63(2)	45(2)	35.8(17)	7.7(15)	20.1(17)	34.6(19)
C37	66(2)	63(2)	36.0(18)	15.7(17)	30.0(17)	43(2)
C38	42.9(18)	51(2)	30.1(16)	16.5(14)	20.6(14)	25.5(16)
C39	29.0(15)	33.6(16)	21.4(13)	7.8(11)	9.5(11)	15.7(13)
C40	20.8(13)	35.3(16)	25.1(14)	7.1(12)	11.6(11)	6.0(12)
C41	31.9(16)	49(2)	32.8(16)	11.3(14)	12.5(13)	17.8(15)
C42	36.0(18)	71(3)	34.1(17)	18.1(17)	9.8(14)	23.9(18)
C43	29.9(17)	67(3)	28.7(16)	1.5(16)	6.4(13)	10.1(17)
C44	37.1(18)	52(2)	35.1(17)	-6.7(16)	6.7(14)	11.6(17)
C45	32.5(17)	40.4(19)	33.6(16)	3.9(14)	9.1(13)	10.7(15)
C46	31.8(15)	27.7(15)	26.9(14)	5.8(12)	17.1(12)	4.2(13)
C47	33.7(17)	59(2)	34.3(17)	11.4(16)	17.4(14)	6.6(16)
C48	40(2)	67(3)	48(2)	9.5(19)	28.3(17)	1.0(19)
C49	63(2)	42(2)	52(2)	12.5(17)	42(2)	1.3(18)
C50	67(2)	40(2)	38.7(18)	18.0(15)	31.8(18)	18.4(18)
C51	42.9(18)	32.0(17)	34.2(16)	12.0(13)	22.6(14)	12.6(14)

Table S 4. Bond Lengths for **Eu-1** complex.

Atom	Atom	Length/Å		Atom	Atom	Length/Å
Eu1	O1	2.3614(18)		C7	C8	1.377(4)
Eu1	O2	2.3773(19)		C8	C10	1.529(5)
Eu1	O4	2.4037(18)		C11	C12	1.429(5)
Eu1	O5	2.3842(19)		C11	C14	1.514(5)
Eu1	O6	2.4224(19)		C12	C13	1.356(5)
Eu1	O7	2.3894(19)		C13	C15	1.522(4)
Eu1	O8	2.437(2)		C16	C17	1.380(4)
Eu1	O9	2.3729(18)		C16	C21	1.397(4)
P1	O1	1.4910(19)		C17	C18	1.392(4)
P1	C16	1.791(3)		C18	C19	1.381(5)
P1	C22	1.808(3)		C19	C20	1.367(6)
P1	C28	1.800(3)		C20	C21	1.380(5)
P2	O2	1.489(2)		C22	C23	1.398(4)
P2	C39	1.806(3)		C22	C27	1.385(4)
P2	C40	1.799(3)		C23	C24	1.387(4)
P2	C46	1.803(3)		C24	C25	1.383(4)
F1	C5	1.293(8)		C25	C26	1.381(4)
F2	C5	1.342(8)		C26	C27	1.385(4)
F3	C5	1.329(8)		C28	C29	1.390(4)
F1A	C5	1.312(8)		C28	C33	1.386(4)
F2A	C5	1.215(9)		C29	C30	1.385(4)
F3A	C5	1.276(8)		C30	C31	1.377(5)
F4	C10	1.333(4)		C31	C32	1.378(5)
F5	C10	1.336(4)		C32	C33	1.389(4)
F6	C10	1.324(4)		C34	C35	1.385(4)
F7	C15	1.302(4)		C34	C39	1.400(4)
F8	C15	1.351(5)		C35	C36	1.379(4)
F9	C15	1.331(4)		C36	C37	1.371(5)
O3	C27	1.392(3)		C37	C38	1.387(5)
O3	C34	1.370(3)		C38	C39	1.400(4)
O4	C1	1.254(3)		C40	C41	1.387(4)
O5	C3	1.259(3)		C40	C45	1.388(4)
O6	C6	1.253(3)		C41	C42	1.396(4)
O7	C8	1.258(3)		C42	C43	1.368(5)
O8	C11	1.243(3)		C43	C44	1.368(5)
O9	C13	1.267(3)		C44	C45	1.386(4)
C1	C2	1.413(4)		C46	C47	1.391(4)
C1	C4	1.503(4)		C46	C51	1.382(4)
C2	C3	1.369(4)		C47	C48	1.382(5)

C3	C5	1.530(5)		C48	C49	1.372(6)
C6	C7	1.414(5)		C49	C50	1.371(5)
C6	C9	1.506(4)		C50	C51	1.393(4)

Table S 5. Bond Angles for **Eu-1** complex.

Atom	Atom	Atom	Angle/˚		Atom	Atom	Atom	Angle/˚
O1	Eu1	O2	74.89(6)		O7	C8	C10	114.2(3)
O1	Eu1	O4	95.11(6)		C7	C8	C10	117.3(3)
O1	Eu1	O5	77.81(7)		F4	C10	F5	107.0(3)
O1	Eu1	O6	149.27(7)		F4	C10	C8	113.1(3)
O1	Eu1	O7	140.04(6)		F5	C10	C8	111.6(3)
O1	Eu1	O8	72.48(6)		F6	C10	F4	106.3(3)
O1	Eu1	O9	104.71(6)		F6	C10	F5	105.2(3)
O2	Eu1	O4	82.26(6)		F6	C10	C8	113.1(3)
O2	Eu1	O5	138.87(6)		O8	C11	C12	123.5(3)
O2	Eu1	O6	75.81(7)		O8	C11	C14	117.5(3)
O2	Eu1	O7	141.07(6)		C12	C11	C14	118.9(3)
O2	Eu1	O8	122.60(7)		C13	C12	C11	122.6(3)
O4	Eu1	O6	71.85(6)		O9	C13	C12	128.8(3)
O4	Eu1	O8	145.75(7)		O9	C13	C15	111.8(3)
O5	Eu1	O4	70.13(7)		C12	C13	C15	119.4(3)
O5	Eu1	O6	120.56(7)		F7	C15	F8	106.2(3)
O5	Eu1	O7	77.16(7)		F7	C15	F9	108.0(3)
O5	Eu1	O8	76.01(7)		F7	C15	C13	115.8(3)
O6	Eu1	O8	132.95(6)		F8	C15	C13	110.8(3)
O7	Eu1	O4	104.93(6)		F9	C15	F8	103.0(3)
O7	Eu1	O6	70.65(7)		F9	C15	C13	112.2(3)
O7	Eu1	O8	71.56(7)		C17	C16	P1	116.9(2)
O9	Eu1	O2	74.19(6)		C17	C16	C21	119.4(3)
O9	Eu1	O4	143.67(7)		C21	C16	P1	123.5(3)
O9	Eu1	O5	143.33(7)		C16	C17	C18	120.2(3)
O9	Eu1	O6	75.75(6)		C19	C18	C17	119.3(4)
O9	Eu1	O7	78.83(6)		C20	C19	C18	121.0(3)
O9	Eu1	O8	70.30(7)		C19	C20	C21	119.9(3)
O1	P1	C16	110.51(13)		C20	C21	C16	120.2(3)
O1	P1	C22	111.69(11)		C23	C22	P1	123.2(2)
O1	P1	C28	112.69(12)		C27	C22	P1	118.24(19)
C16	P1	C22	105.18(13)		C27	C22	C23	118.2(2)
C16	P1	C28	110.01(14)		C24	C23	C22	120.3(3)
C28	P1	C22	106.42(13)		C25	C24	C23	120.1(3)
O2	P2	C39	113.84(12)		C26	C25	C24	120.6(3)

O2	P2	C40	112.76(12)		C25	C26	C27	118.8(3)
O2	P2	C46	111.25(13)		C22	C27	O3	117.4(2)
C40	P2	C39	106.72(13)		C22	C27	C26	122.0(3)
C40	P2	C46	105.88(13)		C26	C27	O3	120.3(3)
C46	P2	C39	105.81(13)		C29	C28	P1	121.7(2)
P1	O1	Eu1	160.38(11)		C33	C28	P1	118.8(2)
P2	O2	Eu1	169.51(12)		C33	C28	C29	119.5(3)
C34	O3	C27	119.6(2)		C30	C29	C28	120.3(3)
C1	O4	Eu1	138.71(19)		C31	C30	C29	119.9(3)
C3	O5	Eu1	134.95(19)		C30	C31	C32	120.2(3)
C6	O6	Eu1	133.88(19)		C31	C32	C33	120.3(3)
C8	O7	Eu1	130.58(19)		C28	C33	C32	119.8(3)
C11	O8	Eu1	134.09(19)		O3	C34	C35	123.3(3)
C13	O9	Eu1	132.49(19)		O3	C34	C39	115.0(2)
O4	C1	C2	123.1(3)		C35	C34	C39	121.8(3)
O4	C1	C4	118.8(3)		C36	C35	C34	118.6(3)
C2	C1	C4	118.1(3)		C37	C36	C35	121.4(3)
C3	C2	C1	122.4(3)		C36	C37	C38	119.9(3)
O5	C3	C2	128.7(3)		C37	C38	C39	120.6(3)
O5	C3	C5	114.1(3)		C34	C39	P2	119.8(2)
C2	C3	C5	117.1(3)		C34	C39	C38	117.7(3)
F1	C5	F2	104.5(7)		C38	C39	P2	122.5(2)
F1	C5	F3	104.9(7)		C41	C40	P2	123.1(2)
F1	C5	C3	116.9(5)		C41	C40	C45	119.6(3)
F2	C5	C3	115.2(4)		C45	C40	P2	117.3(2)
F3	C5	F2	100.6(7)		C40	C41	C42	119.7(3)
F3	C5	C3	113.0(5)		C43	C42	C41	119.7(3)
F1A	C5	C3	106.1(5)		C44	C43	C42	121.1(3)
F2A	C5	F1A	109.6(9)		C43	C44	C45	119.9(3)
F2A	C5	F3A	111.7(8)		C44	C45	C40	120.0(3)
F2A	C5	C3	111.8(5)		C47	C46	P2	121.0(2)
F3A	C5	F1A	104.1(7)		C51	C46	P2	118.9(2)
F3A	C5	C3	112.9(5)		C51	C46	C47	120.2(3)
O6	C6	C7	124.1(3)		C48	C47	C46	120.0(3)
O6	C6	C9	117.6(3)		C49	C48	C47	119.6(3)
C7	C6	C9	118.2(3)		C50	C49	C48	120.8(3)
C8	C7	C6	122.6(3)		C49	C50	C51	120.4(3)
O7	C8	C7	128.4(3)		C46	C51	C50	119.0(3)

Table S 6. Torsion Angles for **Eu-1** complex.

A	B	C	D	Angle/°		A	B	C	D	Angle/°
Eu1	O4	C1	C2	-9.4(4)		C16	P1	O1	Eu1	91.5(3)
Eu1	O4	C1	C4	173.62(19)		C16	P1	C22	C23	1.9(3)
Eu1	O5	C3	C2	11.0(5)		C16	P1	C22	C27	175.3(2)
Eu1	O5	C3	C5	-171.0(2)		C16	P1	C28	C29	69.9(3)
Eu1	O6	C6	C7	-18.2(4)		C16	P1	C28	C33	-111.8(2)
Eu1	O6	C6	C9	161.3(2)		C16	C17	C18	C19	0.2(6)
Eu1	O7	C8	C7	26.8(4)		C17	C16	C21	C20	1.5(5)
Eu1	O7	C8	C10	-156.2(2)		C17	C18	C19	C20	0.8(6)
Eu1	O8	C11	C12	-23.9(5)		C18	C19	C20	C21	-0.6(6)
Eu1	O8	C11	C14	156.0(3)		C19	C20	C21	C16	-0.6(5)
Eu1	O9	C13	C12	21.2(5)		C21	C16	C17	C18	-1.3(5)
Eu1	O9	C13	C15	-159.9(2)		C22	P1	O1	Eu1	-151.8(3)
P1	C16	C17	C18	173.4(3)		C22	P1	C16	C17	-106.2(2)
P1	C16	C21	C20	-172.8(3)		C22	P1	C16	C21	68.3(3)
P1	C22	C23	C24	173.1(2)		C22	P1	C28	C29	-43.5(3)
P1	C22	C27	O3	-0.4(3)		C22	P1	C28	C33	134.7(2)
P1	C22	C27	C26	-174.1(2)		C22	C23	C24	C25	0.6(4)
P1	C28	C29	C30	178.9(3)		C23	C22	C27	O3	173.3(2)
P1	C28	C33	C32	-177.6(3)		C23	C22	C27	C26	-0.3(4)
P2	C40	C41	C42	-179.7(2)		C23	C24	C25	C26	-0.2(4)
P2	C40	C45	C44	178.6(3)		C24	C25	C26	C27	-0.5(4)
P2	C46	C47	C48	-176.8(3)		C25	C26	C27	O3	-172.7(2)
P2	C46	C51	C50	177.3(2)		C25	C26	C27	C22	0.8(4)
O1	P1	C16	C17	14.5(3)		C27	O3	C34	C35	-7.8(4)
O1	P1	C16	C21	-171.1(2)		C27	O3	C34	C39	174.0(2)
O1	P1	C22	C23	-118.1(2)		C27	C22	C23	C24	-0.3(4)
O1	P1	C22	C27	55.4(2)		C28	P1	O1	Eu1	-32.0(4)
O1	P1	C28	C29	-166.3(2)		C28	P1	C16	C17	139.6(2)
O1	P1	C28	C33	12.0(3)		C28	P1	C16	C21	-46.0(3)
O2	P2	C39	C34	52.1(3)		C28	P1	C22	C23	118.6(2)
O2	P2	C39	C38	-127.7(2)		C28	P1	C22	C27	-68.0(2)
O2	P2	C40	C41	-129.6(2)		C28	C29	C30	C31	-1.2(6)
O2	P2	C40	C45	51.2(3)		C29	C28	C33	C32	0.7(5)
O2	P2	C46	C47	-163.9(3)		C29	C30	C31	C32	0.2(6)
O2	P2	C46	C51	17.9(3)		C30	C31	C32	C33	1.2(6)
O3	C34	C35	C36	-178.2(3)		C31	C32	C33	C28	-1.6(5)
O3	C34	C39	P2	-1.4(3)		C33	C28	C29	C30	0.7(5)
O3	C34	C39	C38	178.4(2)		C34	O3	C27	C22	111.7(3)
O4	C1	C2	C3	-3.3(5)		C34	O3	C27	C26	-74.6(3)

O5	C3	C5	F1	127.1(11)		C34	C35	C36	C37	0.0(5)
O5	C3	C5	F2	3.9(10)		C35	C34	C39	P2	-179.7(2)
O5	C3	C5	F3	-111.0(10)		C35	C34	C39	C38	0.2(4)
O5	C3	C5	F1A	58.7(10)		C35	C36	C37	C38	0.2(5)
O5	C3	C5	F2A	-60.9(14)		C36	C37	C38	C39	-0.1(5)
O5	C3	C5	F3A	172.1(9)		C37	C38	C39	P2	179.8(2)
O6	C6	C7	C8	-6.2(5)		C37	C38	C39	C34	0.0(4)
O7	C8	C10	F4	150.4(3)		C39	P2	O2	Eu1	-161.0(6)
O7	C8	C10	F5	-88.9(3)		C39	P2	C40	C41	-3.9(3)
O7	C8	C10	F6	29.5(4)		C39	P2	C40	C45	176.9(2)
O8	C11	C12	C13	0.0(6)		C39	P2	C46	C47	72.0(3)
O9	C13	C15	F7	175.0(3)		C39	P2	C46	C51	-106.2(3)
O9	C13	C15	F8	-64.1(4)		C39	C34	C35	C36	-0.1(4)
O9	C13	C15	F9	50.4(4)		C40	P2	O2	Eu1	-39.2(7)
C1	C2	C3	O5	2.3(5)		C40	P2	C39	C34	-72.9(2)
C1	C2	C3	C5	-175.6(3)		C40	P2	C39	C38	107.2(3)
C2	C3	C5	F1	-54.6(12)		C40	P2	C46	C47	-41.1(3)
C2	C3	C5	F2	-177.9(9)		C40	P2	C46	C51	140.7(2)
C2	C3	C5	F3	67.2(10)		C40	C41	C42	C43	1.3(5)
C2	C3	C5	F1A	-123.1(10)		C41	C40	C45	C44	-0.5(5)
C2	C3	C5	F2A	117.4(13)		C41	C42	C43	C44	-1.0(5)
C2	C3	C5	F3A	-9.6(10)		C42	C43	C44	C45	-0.1(5)
C4	C1	C2	C3	173.7(3)		C43	C44	C45	C40	0.9(5)
C6	C7	C8	O7	1.5(5)		C45	C40	C41	C42	-0.5(4)
C6	C7	C8	C10	-175.3(3)		C46	P2	O2	Eu1	79.5(6)
C7	C8	C10	F4	-32.3(4)		C46	P2	C39	C34	174.6(2)
C7	C8	C10	F5	88.4(4)		C46	P2	C39	C38	-5.3(3)
C7	C8	C10	F6	-153.2(3)		C46	P2	C40	C41	108.5(3)
C9	C6	C7	C8	174.4(3)		C46	P2	C40	C45	-70.6(2)
C11	C12	C13	O9	1.4(6)		C46	C47	C48	C49	-1.3(6)
C11	C12	C13	C15	-177.5(3)		C47	C46	C51	C50	-1.0(5)
C12	C13	C15	F7	-6.0(5)		C47	C48	C49	C50	0.7(6)
C12	C13	C15	F8	114.9(4)		C48	C49	C50	C51	-0.3(6)
C12	C13	C15	F9	-130.6(3)		C49	C50	C51	C46	0.4(5)
C14	C11	C12	C13	-179.9(3)		C51	C46	C47	C48	1.4(5)

Table S 7. Hydrogen Atom Coordinates (Å×10^4) and Isotropic Displacement Parameters (Å^2×10^3) for **Eu-1** complex.

Atom	*x*	*y*	*z*	U(eq)
H2	1003	1195	-563	44
H4A	-1973	345	-690	59
H4B	-1170	116	-1160	59
H4C	-1395	1192	-1177	59
H7	420	-937	3262	45
H9A	-2408	-855	1998	75
H9B	-1767	-1107	2913	75
H9C	-1898	-1769	2031	75
H12	3472	2756	5198	50
H14A	5179	3192	4194	94
H14B	5250	3824	5066	94
H14C	5189	4365	4251	94
H17	3419	4422	1952	47
H18	5357	5160	1962	64
H19	6521	6976	2532	66
H20	5806	8052	3115	61
H21	3888	7328	3117	49
H23	2524	6725	1305	33
H24	1372	7217	122	38
H25	-718	6551	-350	39
H26	-1677	5382	352	36
H29	2086	7186	3257	46
H30	1859	7714	4517	58
H31	1350	6484	5335	59
H32	1075	4729	4905	54
H33	1378	4205	3676	41
H35	-692	6396	2213	43
H36	-1611	6655	3133	53
H37	-2673	5245	3586	56
H38	-2829	3530	3129	45
H41	-3480	3412	748	45
H42	-4784	2743	-735	56
H43	-5073	1101	-1451	56
H44	-4049	124	-737	56
H45	-2700	795	726	46
H47	-4382	1674	1889	54
H48	-5296	647	2687	66
H49	-4165	77	3809	63

H50	-2127	555	4170	55
H51	-1179	1607	3390	42

Table S 8. Atomic Occupancy for **Eu-1** complex.

Atom	*Occupancy*		Atom	*Occupancy*		Atom	*Occupancy*
F1	0.503(15)		F2	0.503(15)		F3	0.503(15)
F1A	0.497(15)		F2A	0.497(15)		F3A	0.497(15)

Table S 9. Fractional Atomic Coordinates (×10^4) and Equivalent Isotropic Displacement Parameters (Å^2×10^3) for **Tb-2** complex. U_{eq} is defined as 1/3 of of the trace of the orthogonalised U_{IJ} tensor.

Atom	*x*	*y*	*z*	U(eq)
Tb1	932.1(2)	2218.8(2)	2216.0(2)	21.91(5)
P1	1904.9(7)	5182.4(6)	2371.2(5)	24.37(16)
P2	-1930.9(7)	2609.7(6)	2019.6(5)	25.85(17)
F1	3286(15)	1506(9)	168(14)	111(6)
F2	4199(8)	2740(19)	1267(5)	101(6)
F3	3347(10)	3044(14)	84(12)	115(6)
F1A	3818(11)	1838(17)	1129(9)	108(4)
F2A	3831(18)	3224(8)	749(18)	139(8)
F3A	3037(12)	1798(16)	-192(7)	108(7)
F4	2487(3)	-458(3)	4166.3(19)	90.8(10)
F5	2778(3)	-732(2)	3006.0(19)	82.2(9)
F6	3674(2)	798(2)	3844.6(18)	68.6(7)
F7	1992(3)	1875(3)	5737.7(18)	113.3(13)
F8	642(3)	2449(2)	5177.6(17)	81.8(9)
F9	361(3)	894(2)	4645.5(17)	73.9(8)
O1	1430.4(18)	3995.6(16)	2106.9(13)	25.8(4)
O2	-736.4(18)	2582.2(17)	2175.3(13)	28.0(4)
O3	-680.9(19)	4563.3(16)	1606.3(14)	28.8(5)
O4	-287.0(19)	1506.9(17)	699.2(13)	29.4(5)
O5	2185(2)	2429.8(18)	1446.9(14)	33.3(5)
O6	-595(2)	509.4(17)	2041.4(14)	32.6(5)
O7	1864(2)	1033.6(17)	2652.8(14)	30.9(5)
O8	2950(2)	3245.8(17)	3296.0(14)	33.9(5)
O9	939.3(19)	2212.5(17)	3615.1(13)	29.8(5)
C1	-166(3)	1232(2)	20.2(19)	30.3(7)
C2	963(3)	1446(3)	-15(2)	39.0(8)
C3	2031(3)	2036(3)	693(2)	33.3(7)

C4	-1275(4)	684(3)	-814(2)	43.5(9)
C5	3203(4)	2294(4)	559(3)	58.3(11)
C6	-604(3)	-248(3)	2413(2)	36.6(8)
C7	447(3)	-393(3)	2920(2)	40.8(8)
C8	1576(3)	248(3)	2991(2)	34.8(8)
C9	-1807(4)	-1055(3)	2310(3)	51.9(10)
C10	2618(4)	-35(3)	3507(3)	46.6(9)
C11	3526(3)	3217(3)	4053(2)	39.8(8)
C12	2968(3)	2756(3)	4609(2)	42.8(9)
C13	1748(3)	2306(3)	4346(2)	34.0(7)
C14	4889(4)	3696(4)	4401(3)	63.6(12)
C15	1215(4)	1869(4)	4983(2)	50.8(10)
C16	3450(3)	5783(3)	2516(2)	31.3(7)
C17	3898(3)	5141(3)	2192(2)	41.3(8)
C18	5039(4)	5579(4)	2203(3)	59.2(11)
C19	5734(4)	6654(4)	2544(3)	58.9(11)
C20	5315(3)	7294(3)	2882(3)	51.6(10)
C21	4177(3)	6863(3)	2873(2)	44.4(9)
C22	1119(3)	5725(2)	1533.5(18)	25.9(6)
C23	1674(3)	6434(2)	1109(2)	30.4(7)
C24	999(3)	6736(3)	413(2)	34.4(7)
C25	-235(3)	6343(3)	138(2)	34.3(8)
C26	-808(3)	5653(3)	549(2)	33.3(7)
C27	-127(3)	5349(2)	1239.6(19)	26.2(6)
C28	1757(3)	5633(2)	3348.7(19)	28.9(7)
C29	1901(3)	6674(3)	3594(2)	40.0(8)
C30	1750(4)	6990(3)	4335(2)	50.5(10)
C31	1453(4)	6269(3)	4826(2)	52.6(10)
C32	1289(4)	5225(3)	4578(2)	48.8(10)
C33	1455(3)	4904(3)	3842(2)	35.9(8)
C34	-1221(3)	4789(3)	2130.6(19)	29.1(7)
C35	-1121(3)	5811(3)	2401(2)	37.7(8)
C36	-1671(4)	5960(3)	2946(2)	47.8(10)
C37	-2298(4)	5121(3)	3213(2)	49.3(10)
C38	-2389(3)	4103(3)	2944(2)	39.3(8)
C39	-1846(3)	3918(3)	2391.9(19)	29.9(7)
C40	-2956(3)	2165(3)	884.3(19)	29.3(7)
C41	-3578(3)	2738(3)	456(2)	40.5(8)
C42	-4368(3)	2338(4)	-418(2)	49.5(10)
C43	-4539(3)	1367(4)	-852(2)	49.2(10)
C44	-3926(3)	796(4)	-428(2)	50.7(10)
C45	-3125(3)	1186(3)	438(2)	40.3(8)
C46	-2683(3)	1746(3)	2578(2)	32.7(7)

C47	-3910(3)	1445(3)	2364(2)	48.3(10)
C48	-4451(4)	827(4)	2834(3)	57.2(12)
C49	-3779(4)	499(3)	3503(3)	55.7(11)
C50	-2568(4)	785(3)	3720(3)	49.9(10)
C51	-2008(3)	1416(3)	3256(2)	38.0(8)

Table S 10. Anisotropic Displacement Parameters (Å^2×10^3) for **Tb-2** complex. The Anisotropic displacement factor exponent takes the form: $-2\pi^2[h^2a^{*2}U_{11}+2hka^*b^*U_{12}+\ldots]$

Atom	U_{11}	U_{22}	U_{33}	U_{23}	U_{13}	U_{12}
Tb1	25.42(8)	19.09(8)	21.53(8)	6.96(5)	9.90(6)	8.37(6)
P1	26.3(4)	20.0(4)	25.5(4)	8.3(3)	9.4(3)	8.3(3)
P2	24.4(4)	29.4(4)	25.6(4)	9.0(3)	12.6(3)	9.8(3)
F1	113(10)	67(5)	203(17)	3(8)	124(12)	35(6)
F2	43(4)	187(16)	69(5)	7(6)	33(3)	37(7)
F3	84(6)	151(12)	174(11)	124(10)	93(8)	59(7)
F1A	48(5)	162(13)	133(9)	45(8)	39(5)	59(7)
F2A	129(14)	61(6)	250(20)	-11(10)	160(15)	-13(7)
F3A	71(5)	194(19)	61(5)	-18(6)	46(4)	46(8)
F4	86(2)	140(3)	93(2)	92(2)	50.4(17)	70(2)
F5	94(2)	78(2)	94(2)	13.2(16)	31.4(17)	65.5(19)
F6	55.9(16)	64.4(17)	87.7(18)	29.1(14)	19.7(14)	33.7(14)
F7	82(2)	206(4)	47.8(16)	71(2)	23.1(15)	47(2)
F8	112(2)	90(2)	65.8(17)	14.0(15)	58.9(17)	43.6(19)
F9	104(2)	55.4(16)	63.6(16)	25.0(13)	49.4(16)	15.9(16)
O1	25.7(11)	22.6(10)	31.3(11)	9.0(9)	12.1(9)	10.8(9)
O2	26.0(11)	28.3(11)	31.6(11)	10.8(9)	12.7(9)	11.0(9)
O3	32.2(12)	24.4(11)	38.4(12)	11.0(9)	21.5(10)	13.1(10)
O4	36.0(12)	27.9(11)	26.2(11)	6.9(9)	14.2(9)	13.2(10)
O5	35.0(13)	34.7(13)	34.4(12)	9(1)	18.9(10)	13.4(10)
O6	37.6(13)	24.6(11)	31.1(11)	7.4(9)	13.5(10)	7.7(10)
O7	40.8(13)	25.4(11)	36.4(12)	14.0(9)	21.5(10)	16.9(10)
O8	34.1(12)	29.0(12)	33.4(12)	11(1)	9.9(10)	9.8(10)
O9	34.7(12)	30.6(12)	23.7(11)	7.5(9)	11.1(9)	13.2(10)
C1	47(2)	23.4(15)	24.7(15)	6.3(12)	12.3(14)	21.2(15)
C2	54(2)	44(2)	33.5(18)	8.4(15)	25.3(17)	28.5(19)
C3	44(2)	31.5(17)	42.0(19)	16.9(15)	26.7(16)	23.2(16)
C4	57(2)	41(2)	30.1(18)	1.3(15)	12.2(16)	24.1(19)
C5	54(3)	73(3)	56(3)	7(2)	31(2)	28(3)
C6	48(2)	23.6(16)	34.4(17)	4.6(14)	20.9(16)	5.4(15)
C7	57(2)	31.4(18)	41.7(19)	18.0(15)	25.3(18)	18.8(18)

C8	58(2)	28.3(17)	31.5(17)	13.5(14)	24.7(16)	23.7(17)
C9	55(3)	36(2)	58(2)	15.6(18)	29(2)	3.3(18)
C10	63(3)	44(2)	52(2)	27.0(19)	30(2)	34(2)
C11	36.1(19)	35.2(19)	37.2(19)	6.9(15)	6.2(15)	11.3(16)
C12	43(2)	47(2)	27.3(17)	12.9(15)	3.0(15)	15.9(18)
C13	49(2)	30.2(17)	23.6(16)	9.3(13)	12.1(15)	18.7(16)
C14	34(2)	74(3)	58(3)	16(2)	2.3(19)	10(2)
C15	64(3)	60(3)	28.8(19)	15.5(18)	19.4(18)	24(2)
C16	25.7(16)	26.7(16)	36.7(17)	13.2(14)	9.0(13)	7.4(13)
C17	29.9(18)	35.0(19)	57(2)	12.8(17)	18.8(16)	9.5(16)
C18	34(2)	54(3)	91(3)	18(2)	31(2)	13(2)
C19	27(2)	56(3)	85(3)	25(2)	21(2)	7.9(19)
C20	31(2)	34(2)	66(3)	17.0(18)	4.4(18)	1.2(16)
C21	35(2)	31.6(19)	52(2)	8.8(16)	7.8(16)	7.2(16)
C22	35.3(17)	22.2(15)	23.0(14)	6.4(12)	12.8(13)	13.3(13)
C23	38.9(18)	24.7(16)	32.2(16)	8.2(13)	17.8(14)	14.2(14)
C24	56(2)	27.0(16)	35.0(17)	14.7(14)	27.6(16)	22.2(16)
C25	55(2)	26.6(17)	26.4(16)	9.4(13)	13.0(15)	25.1(16)
C26	36.9(18)	27.9(16)	33.0(17)	5.6(14)	9.4(14)	15.8(15)
C27	35.8(17)	18.6(14)	27.4(15)	6.0(12)	13.6(13)	13.4(13)
C28	31.6(17)	28.8(16)	22.7(15)	6.0(12)	6.5(12)	12.5(14)
C29	57(2)	30.7(18)	31.3(17)	8.8(14)	16.5(16)	17.2(17)
C30	78(3)	38(2)	37(2)	3.8(16)	19.4(19)	29(2)
C31	78(3)	53(2)	31.3(19)	5.7(17)	23.8(19)	32(2)
C32	72(3)	46(2)	33.2(19)	16.3(17)	26.3(19)	23(2)
C33	50(2)	30.6(17)	29.4(17)	10.5(14)	15.0(15)	18.9(16)
C34	27.4(16)	37.9(18)	23.3(15)	6.4(13)	7.2(12)	17.5(14)
C35	49(2)	35.9(19)	34.3(18)	10.0(15)	16.2(16)	24.6(17)
C36	70(3)	51(2)	39(2)	10.6(18)	22.9(19)	42(2)
C37	66(3)	67(3)	40(2)	13.2(19)	29.4(19)	46(2)
C38	44(2)	53(2)	37.7(18)	20.1(17)	25.3(16)	27.8(18)
C39	30.5(17)	37.2(18)	26.3(15)	9.4(13)	11.5(13)	17.9(15)
C40	21.3(15)	37.2(18)	26.8(15)	7.6(13)	11.2(12)	7.2(13)
C41	35.2(19)	52(2)	36.2(18)	11.3(16)	13.2(15)	20.3(17)
C42	39(2)	71(3)	38(2)	16(2)	11.3(16)	27(2)
C43	30.6(19)	74(3)	31.6(18)	4.9(19)	7.2(15)	15(2)
C44	39(2)	58(3)	39(2)	-7.0(18)	9.4(16)	11.5(19)
C45	34.9(19)	44(2)	37.2(18)	3.2(16)	12.4(15)	13.6(16)
C46	33.6(18)	32.1(17)	30.8(16)	5.9(14)	19.5(14)	5.2(14)
C47	34(2)	64(3)	42(2)	12.9(18)	21.1(17)	8.5(19)
C48	40(2)	69(3)	51(2)	7(2)	29.7(19)	-2(2)
C49	71(3)	46(2)	54(2)	14.6(19)	44(2)	8(2)
C50	74(3)	44(2)	46(2)	20.4(18)	39(2)	23(2)

C51	47(2)	39(2)	35.3(18)	13.7(15)	24.3(16)	17.3(17)

Table S 11. Bond Lengths for **Tb-2** complex**.**

Atom	Atom	Length/Å		Atom	Atom	Length/Å
Tb1	O1	2.334(2)		C7	C8	1.375(5)
Tb1	O2	2.357(2)		C8	C10	1.521(5)
Tb1	O4	2.377(2)		C11	C12	1.428(5)
Tb1	O5	2.363(2)		C11	C14	1.515(5)
Tb1	O6	2.399(2)		C12	C13	1.363(5)
Tb1	O7	2.357(2)		C13	C15	1.518(5)
Tb1	O8	2.410(2)		C16	C17	1.380(5)
Tb1	O9	2.347(2)		C16	C21	1.393(5)
P1	O1	1.492(2)		C17	C18	1.379(5)
P1	C16	1.793(3)		C18	C19	1.377(6)
P1	C22	1.802(3)		C19	C20	1.363(6)
P1	C28	1.805(3)		C20	C21	1.377(5)
P2	O2	1.488(2)		C22	C23	1.398(4)
P2	C39	1.806(3)		C22	C27	1.390(4)
P2	C40	1.802(3)		C23	C24	1.382(4)
P2	C46	1.801(3)		C24	C25	1.376(5)
F1	C5	1.277(11)		C25	C26	1.377(5)
F2	C5	1.308(10)		C26	C27	1.380(4)
F3	C5	1.351(10)		C28	C29	1.383(4)
F1A	C5	1.358(11)		C28	C33	1.387(4)
F2A	C5	1.193(10)		C29	C30	1.385(5)
F3A	C5	1.294(11)		C30	C31	1.375(6)
F4	C10	1.326(4)		C31	C32	1.380(5)
F5	C10	1.340(5)		C32	C33	1.390(5)
F6	C10	1.327(5)		C34	C35	1.386(4)
F7	C15	1.309(4)		C34	C39	1.391(5)
F8	C15	1.352(5)		C35	C36	1.384(5)
F9	C15	1.322(5)		C36	C37	1.367(6)
O3	C27	1.390(4)		C37	C38	1.385(5)
O3	C34	1.378(4)		C38	C39	1.402(4)
O4	C1	1.252(4)		C40	C41	1.378(5)
O5	C3	1.255(4)		C40	C45	1.393(5)
O6	C6	1.251(4)		C41	C42	1.390(5)
O7	C8	1.259(4)		C42	C43	1.373(6)
O8	C11	1.239(4)		C43	C44	1.367(6)
O9	C13	1.264(4)		C44	C45	1.382(5)
C1	C2	1.409(5)		C46	C47	1.392(5)

C1	C4	1.504(5)		C46	C51	1.385(5)
C2	C3	1.377(5)		C47	C48	1.382(5)
C3	C5	1.534(5)		C48	C49	1.372(6)
C6	C7	1.419(5)		C49	C50	1.374(6)
C6	C9	1.504(5)		C50	C51	1.396(5)

Table S 12. Bond Angles for **Tb-2** complex.

Atom	Atom	Atom	Angle/˚		Atom	Atom	Atom	Angle/˚
O1	Tb1	O2	74.77(7)		O7	C8	C10	114.5(3)
O1	Tb1	O4	94.48(7)		C7	C8	C10	117.3(3)
O1	Tb1	O5	77.47(7)		F4	C10	F5	106.8(3)
O1	Tb1	O6	148.52(7)		F4	C10	F6	106.3(3)
O1	Tb1	O7	140.14(7)		F4	C10	C8	113.5(3)
O1	Tb1	O8	72.48(7)		F5	C10	C8	112.2(3)
O1	Tb1	O9	105.10(7)		F6	C10	F5	104.3(3)
O2	Tb1	O4	82.26(7)		F6	C10	C8	113.2(3)
O2	Tb1	O5	139.20(7)		O8	C11	C12	123.3(3)
O2	Tb1	O6	75.37(7)		O8	C11	C14	118.0(3)
O2	Tb1	O7	141.34(7)		C12	C11	C14	118.7(3)
O2	Tb1	O8	122.76(7)		C13	C12	C11	122.5(3)
O4	Tb1	O6	71.80(7)		O9	C13	C12	128.3(3)
O4	Tb1	O8	145.07(7)		O9	C13	C15	111.9(3)
O5	Tb1	O4	70.70(7)		C12	C13	C15	119.8(3)
O5	Tb1	O6	121.26(7)		F7	C15	F8	105.1(3)
O5	Tb1	O8	74.82(8)		F7	C15	F9	108.3(4)
O6	Tb1	O8	133.90(7)		F7	C15	C13	115.6(4)
O7	Tb1	O4	104.93(7)		F8	C15	C13	110.8(3)
O7	Tb1	O5	76.73(7)		F9	C15	F8	103.6(4)
O7	Tb1	O6	71.33(8)		F9	C15	C13	112.5(3)
O7	Tb1	O8	71.77(8)		C17	C16	P1	117.2(2)
O9	Tb1	O2	74.29(7)		C17	C16	C21	119.1(3)
O9	Tb1	O4	143.89(7)		C21	C16	P1	123.6(3)
O9	Tb1	O5	142.62(8)		C16	C17	C18	120.0(4)
O9	Tb1	O6	75.89(7)		C19	C18	C17	120.0(4)
O9	Tb1	O7	78.99(7)		C20	C19	C18	120.8(4)
O9	Tb1	O8	70.79(7)		C19	C20	C21	119.6(4)
O1	P1	C16	110.73(14)		C20	C21	C16	120.5(4)
O1	P1	C22	111.64(13)		C23	C22	P1	123.8(2)
O1	P1	C28	112.71(13)		C27	C22	P1	118.2(2)
C16	P1	C22	105.00(14)		C27	C22	C23	117.7(3)
C16	P1	C28	109.88(15)		C24	C23	C22	120.8(3)

C22	P1	C28	106.52(14)		C25	C24	C23	119.8(3)
O2	P2	C39	113.66(13)		C24	C25	C26	120.9(3)
O2	P2	C40	113.06(13)		C25	C26	C27	119.0(3)
O2	P2	C46	111.56(14)		O3	C27	C22	117.2(3)
C40	P2	C39	106.47(15)		C26	C27	O3	120.6(3)
C46	P2	C39	105.84(15)		C26	C27	C22	121.9(3)
C46	P2	C40	105.64(15)		C29	C28	P1	121.3(2)
P1	O1	Tb1	160.13(12)		C33	C28	P1	118.8(2)
P2	O2	Tb1	168.74(13)		C33	C28	C29	119.9(3)
C34	O3	C27	119.9(2)		C30	C29	C28	120.0(3)
C1	O4	Tb1	138.3(2)		C31	C30	C29	120.1(3)
C3	O5	Tb1	134.7(2)		C30	C31	C32	120.2(3)
C6	O6	Tb1	133.7(2)		C31	C32	C33	120.1(3)
C8	O7	Tb1	130.9(2)		C28	C33	C32	119.6(3)
C11	O8	Tb1	134.5(2)		O3	C34	C35	122.8(3)
C13	O9	Tb1	132.6(2)		O3	C34	C39	114.9(3)
O4	C1	C2	123.4(3)		C35	C34	C39	122.2(3)
O4	C1	C4	118.7(3)		C36	C35	C34	118.4(3)
C2	C1	C4	117.8(3)		C37	C36	C35	121.0(3)
C3	C2	C1	122.0(3)		C36	C37	C38	120.4(3)
O5	C3	C2	128.5(3)		C37	C38	C39	120.4(3)
O5	C3	C5	114.0(3)		C34	C39	P2	119.9(2)
C2	C3	C5	117.5(3)		C34	C39	C38	117.5(3)
F1	C5	F2	106.0(9)		C38	C39	P2	122.6(3)
F1	C5	F3	106.1(8)		C41	C40	P2	123.1(3)
F1	C5	C3	115.5(7)		C41	C40	C45	119.7(3)
F2	C5	F3	101.5(9)		C45	C40	P2	117.1(2)
F2	C5	C3	115.6(4)		C40	C41	C42	120.0(4)
F3	C5	C3	111.0(5)		C43	C42	C41	120.0(4)
F1A	C5	C3	104.4(5)		C44	C43	C42	120.1(3)
F2A	C5	F1A	106.6(12)		C43	C44	C45	120.8(4)
F2A	C5	F3A	114.1(10)		C44	C45	C40	119.3(4)
F2A	C5	C3	114.1(6)		C47	C46	P2	121.3(3)
F3A	C5	F1A	103.0(8)		C51	C46	P2	118.7(3)
F3A	C5	C3	113.2(7)		C51	C46	C47	120.0(3)
O6	C6	C7	124.1(3)		C48	C47	C46	120.0(4)
O6	C6	C9	117.7(3)		C49	C48	C47	119.8(4)
C7	C6	C9	118.2(3)		C48	C49	C50	120.9(4)
C8	C7	C6	122.4(3)		C49	C50	C51	119.9(4)
O7	C8	C7	128.2(3)		C46	C51	C50	119.4(4)

Table S 13. Torsion Angles for **Tb-2** complex**.**

A	B	C	D	Angle/˚		A	B	C	D	Angle/˚
Tb1	O4	C1	C2	-9.9(5)		C16	P1	O1	Tb1	90.9(4)
Tb1	O4	C1	C4	172.8(2)		C16	P1	C22	C23	1.7(3)
Tb1	O5	C3	C2	12.4(5)		C16	P1	C22	C27	176.1(2)
Tb1	O5	C3	C5	-169.8(3)		C16	P1	C28	C29	70.0(3)
Tb1	O6	C6	C7	-18.1(5)		C16	P1	C28	C33	-112.1(3)
Tb1	O6	C6	C9	162.2(2)		C16	C17	C18	C19	0.5(6)
Tb1	O7	C8	C7	26.5(5)		C17	C16	C21	C20	1.7(5)
Tb1	O7	C8	C10	-156.3(2)		C17	C18	C19	C20	0.8(7)
Tb1	O8	C11	C12	-23.2(5)		C18	C19	C20	C21	-0.9(7)
Tb1	O8	C11	C14	156.7(3)		C19	C20	C21	C16	-0.4(6)
Tb1	O9	C13	C12	22.0(5)		C21	C16	C17	C18	-1.8(5)
Tb1	O9	C13	C15	-159.9(2)		C22	P1	O1	Tb1	-152.5(3)
P1	C16	C17	C18	173.4(3)		C22	P1	C16	C17	-106.7(3)
P1	C16	C21	C20	-173.1(3)		C22	P1	C16	C21	68.3(3)
P1	C22	C23	C24	173.5(2)		C22	P1	C28	C29	-43.3(3)
P1	C22	C27	O3	-1.1(3)		C22	P1	C28	C33	134.6(3)
P1	C22	C27	C26	-174.3(2)		C22	C23	C24	C25	0.6(4)
P1	C28	C29	C30	178.3(3)		C23	C22	C27	O3	173.6(2)
P1	C28	C33	C32	-177.5(3)		C23	C22	C27	C26	0.5(4)
P2	C40	C41	C42	-179.1(3)		C23	C24	C25	C26	0.2(5)
P2	C40	C45	C44	178.3(3)		C24	C25	C26	C27	-0.7(5)
P2	C46	C47	C48	-176.6(3)		C25	C26	C27	O3	-172.6(3)
P2	C46	C51	C50	177.3(3)		C25	C26	C27	C22	0.3(4)
O1	P1	C16	C17	13.9(3)		C27	O3	C34	C35	-7.9(4)
O1	P1	C16	C21	-171.1(3)		C27	O3	C34	C39	174.0(3)
O1	P1	C22	C23	-118.4(3)		C27	C22	C23	C24	-0.9(4)
O1	P1	C22	C27	56.0(3)		C28	P1	O1	Tb1	-32.6(4)
O1	P1	C28	C29	-166.0(3)		C28	P1	C16	C17	139.1(3)
O1	P1	C28	C33	11.9(3)		C28	P1	C16	C21	-45.9(3)
O2	P2	C39	C34	52.0(3)		C28	P1	C22	C23	118.2(3)
O2	P2	C39	C38	-127.9(3)		C28	P1	C22	C27	-67.4(3)
O2	P2	C40	C41	-129.6(3)		C28	C29	C30	C31	-0.3(6)
O2	P2	C40	C45	51.5(3)		C29	C28	C33	C32	0.5(5)
O2	P2	C46	C47	-164.2(3)		C29	C30	C31	C32	-0.7(7)
O2	P2	C46	C51	18.3(3)		C30	C31	C32	C33	1.6(7)
O3	C34	C35	C36	-178.3(3)		C31	C32	C33	C28	-1.5(6)
O3	C34	C39	P2	-1.5(4)		C33	C28	C29	C30	0.4(5)
O3	C34	C39	C38	178.5(3)		C34	O3	C27	C22	112.6(3)
O4	C1	C2	C3	-3.9(5)		C34	O3	C27	C26	-74.1(4)

O5	C3	C5	F1	134.5(12)		C34	C35	C36	C37	0.0(6)
O5	C3	C5	F2	10.0(13)		C35	C34	C39	P2	-179.6(2)
O5	C3	C5	F3	-104.8(11)		C35	C34	C39	C38	0.3(5)
O5	C3	C5	F1A	62.4(11)		C35	C36	C37	C38	0.3(6)
O5	C3	C5	F2A	-53.6(18)		C36	C37	C38	C39	-0.3(6)
O5	C3	C5	F3A	173.7(11)		C37	C38	C39	P2	179.9(3)
O6	C6	C7	C8	-5.4(5)		C37	C38	C39	C34	0.0(5)
O7	C8	C10	F4	149.5(3)		C39	P2	O2	Tb1	-162.2(6)
O7	C8	C10	F5	-89.4(4)		C39	P2	C40	C41	-4.1(3)
O7	C8	C10	F6	28.3(4)		C39	P2	C40	C45	177.0(2)
O8	C11	C12	C13	0.1(6)		C39	P2	C46	C47	71.7(3)
O9	C13	C15	F7	175.8(4)		C39	P2	C46	C51	-105.8(3)
O9	C13	C15	F8	-64.8(4)		C39	C34	C35	C36	-0.4(5)
O9	C13	C15	F9	50.7(4)		C40	P2	O2	Tb1	-40.6(7)
C1	C2	C3	O5	2.5(6)		C40	P2	C39	C34	-73.1(3)
C1	C2	C3	C5	-175.3(4)		C40	P2	C39	C38	107.0(3)
C2	C3	C5	F1	-47.5(13)		C40	P2	C46	C47	-41.0(3)
C2	C3	C5	F2	-172.0(12)		C40	P2	C46	C51	141.5(3)
C2	C3	C5	F3	73.2(11)		C40	C41	C42	C43	0.8(6)
C2	C3	C5	F1A	-119.6(10)		C41	C40	C45	C44	-0.6(5)
C2	C3	C5	F2A	124.4(17)		C41	C42	C43	C44	-0.6(6)
C2	C3	C5	F3A	-8.3(12)		C42	C43	C44	C45	-0.3(6)
C4	C1	C2	C3	173.5(3)		C43	C44	C45	C40	0.9(6)
C6	C7	C8	O7	1.0(6)		C45	C40	C41	C42	-0.2(5)
C6	C7	C8	C10	-176.1(3)		C46	P2	O2	Tb1	78.3(7)
C7	C8	C10	F4	-33.0(5)		C46	P2	C39	C34	174.8(3)
C7	C8	C10	F5	88.2(4)		C46	P2	C39	C38	-5.1(3)
C7	C8	C10	F6	-154.2(3)		C46	P2	C40	C41	108.2(3)
C9	C6	C7	C8	174.3(3)		C46	P2	C40	C45	-70.7(3)
C11	C12	C13	O9	0.5(6)		C46	C47	C48	C49	-1.0(6)
C11	C12	C13	C15	-177.6(3)		C47	C46	C51	C50	-0.2(5)
C12	C13	C15	F7	-5.8(6)		C47	C48	C49	C50	0.6(6)
C12	C13	C15	F8	113.5(4)		C48	C49	C50	C51	0.0(6)
C12	C13	C15	F9	-131.0(4)		C49	C50	C51	C46	-0.2(5)
C14	C11	C12	C13	-179.8(4)		C51	C46	C47	C48	0.8(6)

Table S 14. Hydrogen Atom Coordinates (Å×10[4]) and Isotropic Displacement Parameters (Å[2]×10[3]) for **Tb-2** complex.

Atom	*x*	*y*	*z*	U(eq)
H2	987	1175	-542	47
H4A	-1981	367	-678	65
H4B	-1181	121	-1143	65
H4C	-1387	1205	-1167	65
H7	368	-955	3222	49
H9A	-2450	-868	1935	78
H9B	-1839	-1060	2884	78
H9C	-1917	-1765	2043	78
H12	3466	2763	5183	51
H14A	5158	3185	4185	95
H14B	5231	3858	5040	95
H14C	5161	4354	4201	95
H17	3421	4399	1962	50
H18	5346	5139	1976	71
H19	6516	6953	2543	71
H20	5806	8033	3123	62
H21	3885	7307	3113	53
H23	2526	6712	1301	36
H24	1384	7213	125	41
H25	-697	6550	-342	41
H26	-1659	5390	360	40
H29	2102	7172	3255	48
H30	1853	7706	4505	61
H31	1360	6490	5338	63
H32	1063	4724	4910	59
H33	1361	4189	3678	43
H35	-685	6395	2217	45
H36	-1612	6655	3138	57
H37	-2673	5238	3585	59
H38	-2824	3526	3136	47
H41	-3467	3405	759	49
H42	-4788	2737	-715	59
H43	-5085	1092	-1448	59
H44	-4052	124	-732	61
H45	-2694	789	726	48
H47	-4376	1663	1895	58
H48	-5285	630	2694	69
H49	-4155	69	3821	67

H50	-2113	552	4184	60
H51	-1170	1618	3403	46

Table S 15**.** Atomic Occupancy for **Tb-2** complex**.**

Atom	***Occupancy***		**Atom**	***Occupancy***		**Atom**	***Occupancy***
F1	0.513(18)		F2	0.513(18)		F3	0.513(18)
F1A	0.487(18)		F2A	0.487(18)		F3A	0.487(18)

Table S 16 Corrected emission intensity relative to $^5D_0 \rightarrow {}^7F_1$ transition, R_{21} and CIE color coordinates of **Eu-1** and $[Eu(tfac)_3(H_2O)_2]$ in the solid-state and in DCM solution at RT.

	Corrected emission Intenisty relative to $^5D_0 \rightarrow {}^7F_1$ transition						$^aR_{21}$	Color Coordinate	
	$\int 0-0$	$\int 0-1$	$\int 0-2$	$\int 0-3$	$\int 0-4$	$\int total$		x	y
$[Eu(tfac)_3(H_2O)_2]$									
Solid-state	0.19 [17272.39] (1.33%)	1.00 [16875.59] -	10.61 [16232.29] (74.35%)	0.43 [15328.74] (3.01%)	2.04 [14314.11] (14.29%)	14.27	10.61	0.666	0.330
DCM	0.18 [17270.37] (1.12%)	1.00 [16871.00] -	10.38 [16231.59] (74.14%)	0.42 [15328.74] (3.00%)	2.02 [14317.83] (14.40%)	14.00	10.38	0.659	0.332
Eu-1									
Solid-state	0.18 (17259.51) [1.18%]	1.00 (16874.68) -	12.56 (16249.52) [82.41%]	0.35 (15325.23) [2.29%]	1.15 (14355.98) [7.54%]	15.24	12.56	0.664	0.324
DCM	0.20 (17261.80) [1.14%]	1.00 (16872.34) -	13.76 (16215.69) [79.50%]	0.43 (15312.89) [2.46%]	2.02 (14328.91) [11.62%]	17.41	13.76	0.669	0.329

Table S 17. Photophysical properties of $[Eu(tfac)_3(H_2O)_2]$ complex in the solid-state and in DCM solution at RT.

	Ω_2	Ω_2	FWHM	τ_{obs}	τ_{rad}	A_R	A_{NR}	Q_{Eu}^{Eu}	Q_{Eu}^{L}	η_{sen}
	($\times 10^{-20}$ cm^{-2})		(nm)	(μs)	(μs)	(s^{-1})		(%)		
	$[Eu(tfac)_3(H_2O)_2]$									
Solid-state	18.60	8.24	1.00;7.94	384	1317	759.30	1844.87	29.16	-	-
DCM	18.25	8.16	2.40;6.00	254	1583	631.63	3305.38	16.04		

Table S 18**.** The key properties of double-EMLs devices with **Tb-2** at different concentrations.

Device	$V_{turn\text{-}on}$ (V)	B^a (cd/m^2)	$\eta_c{}^b$ (cd/A)	$\eta_p{}^c$ (lm/W)	EQE	$CIE_{x,y}{}^d$
8.0 wt%	3.2	1248	8.83	8.16	3.5%	(0.262, 0.408)
10.0 wt%	3.3	1285	10.44	8.62	4.5%	(0.250, 0.427)
12.0 wt%	3.3	1341	11.96	11.02	4.7%	(0.250, 0.443)
14.0 wt%	3.2	1324	11.50	10.62	5.2%	(0.254, 0.430)
16.0 wt%	3.5	1259	9.53	8.09	3.8%	(0.252, 0.456)

[a]The data for maximum brightness (B). [b] maximum current efficiency (η_c). [c] maximum power efficiency (η_p). [d] Commission Internationalede l'Eclairage coordinates ($CIE_{x,\,y}$) at 10 mA/cm^2.

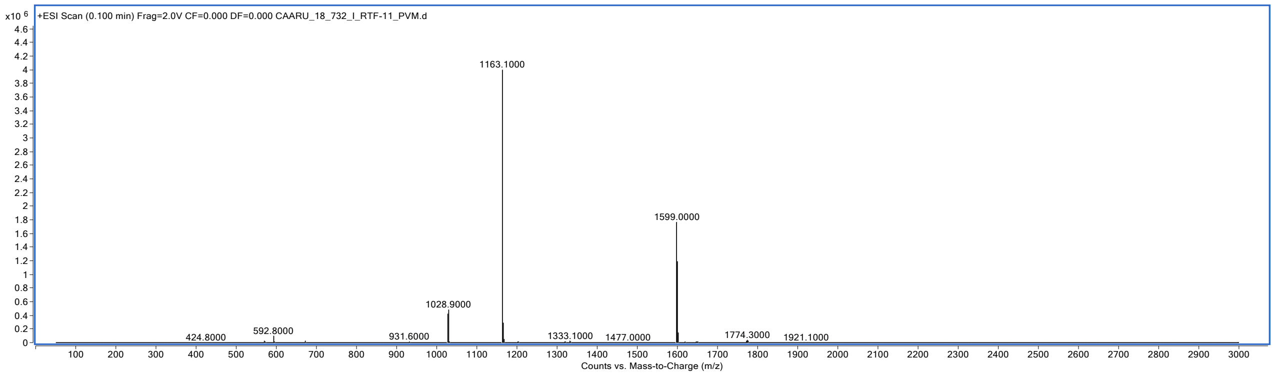

Fig. S 1. Positive mode ESI-MS spectrum of **Eu-1** complex in acetone solution.

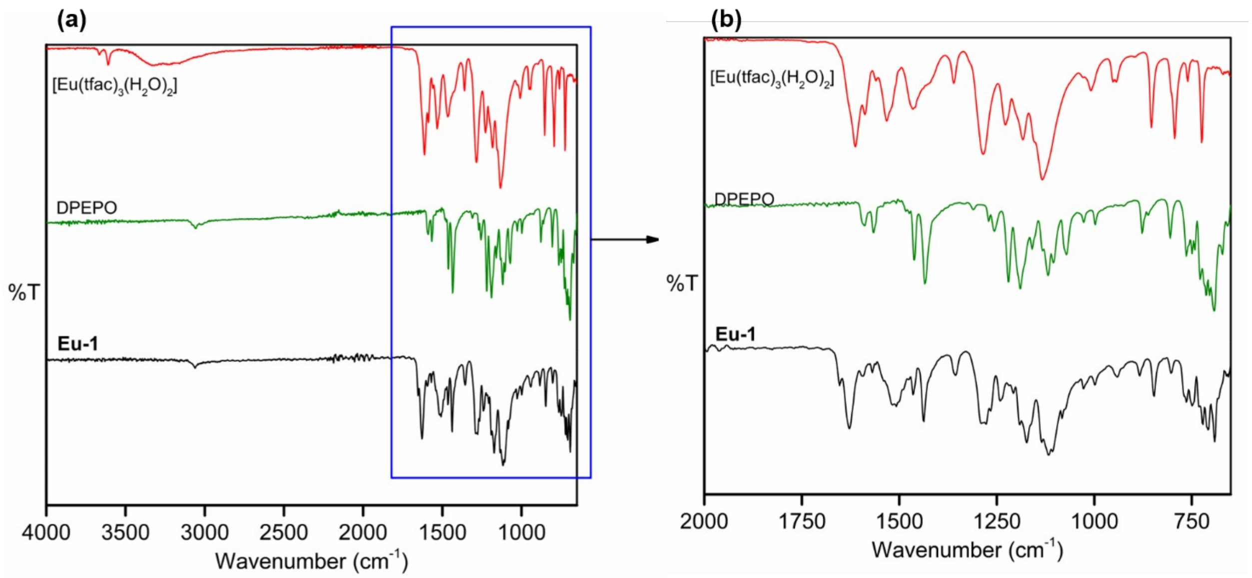

Fig. S 2. FT-IR spectra of free (a) DPEPO, [Eu(tfac)$_2$(H$_2$O)$_2$] and **Eu-1** complex and (b) a magnified view in the range between 2000 – 650 cm^{-1}.

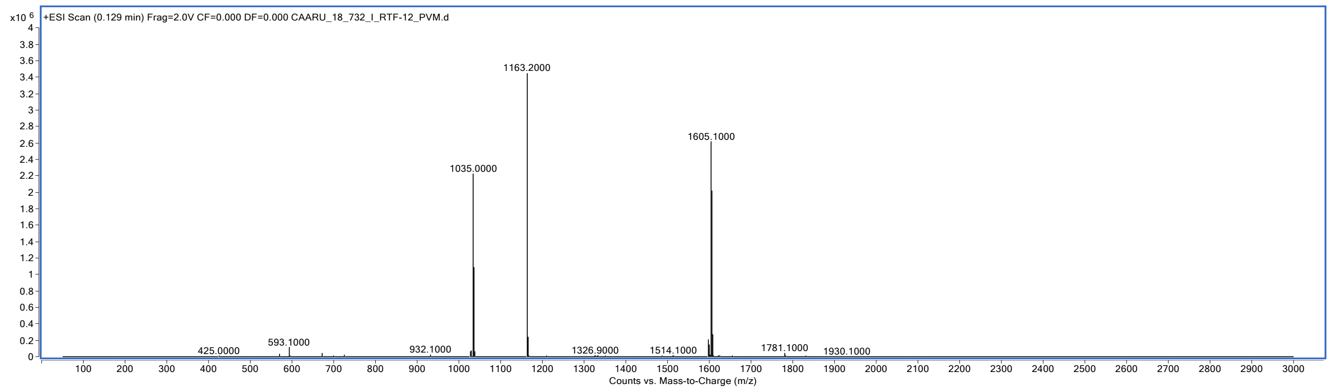

Fig. S 3. Positive mode ESI-MS spectrum of **Tb-2** complex in acetone solution.

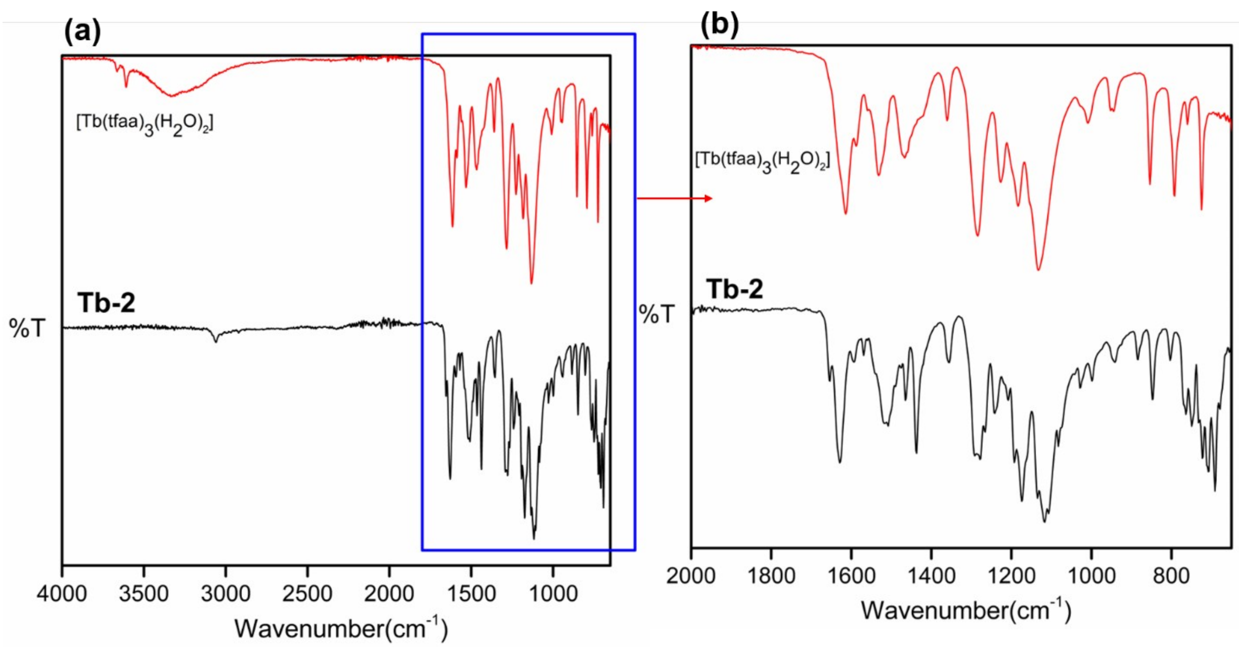

Fig. S 4. FT-IR spectra of (a) $[Tb(tfac)_2(H_2O)_2]$ and **Tb-2** complex and (b) a magnified view in the range between 2000 – 650 cm^{-1} .

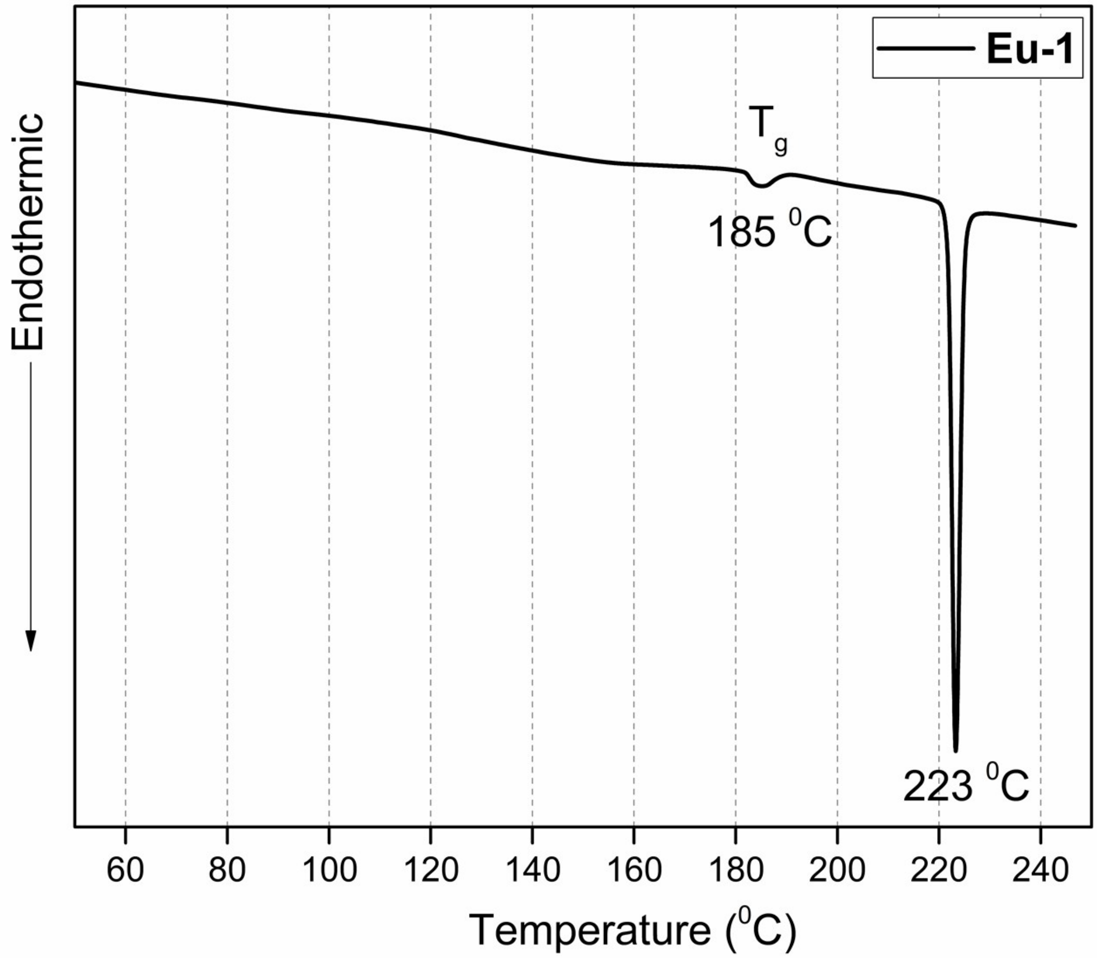

Fig. S 5. DSC curve of **Eu-1** complex recorded under dinitrogen atmosphere with heating rate 10 °C/min.

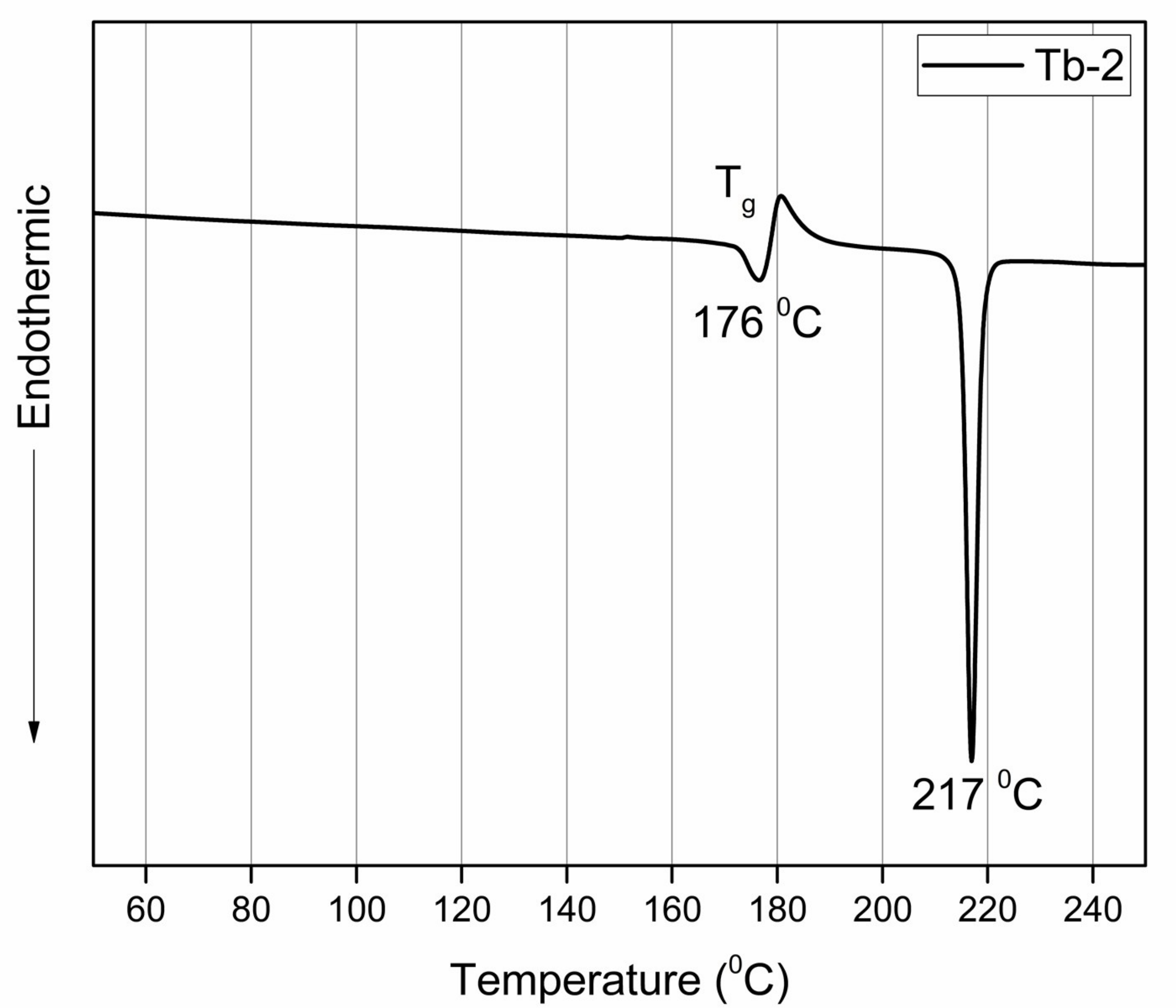

Fig. S 6. DSC curve **Tb-2** complex recorded under dinitrogen atmosphere with heating rate 10 °C/min.

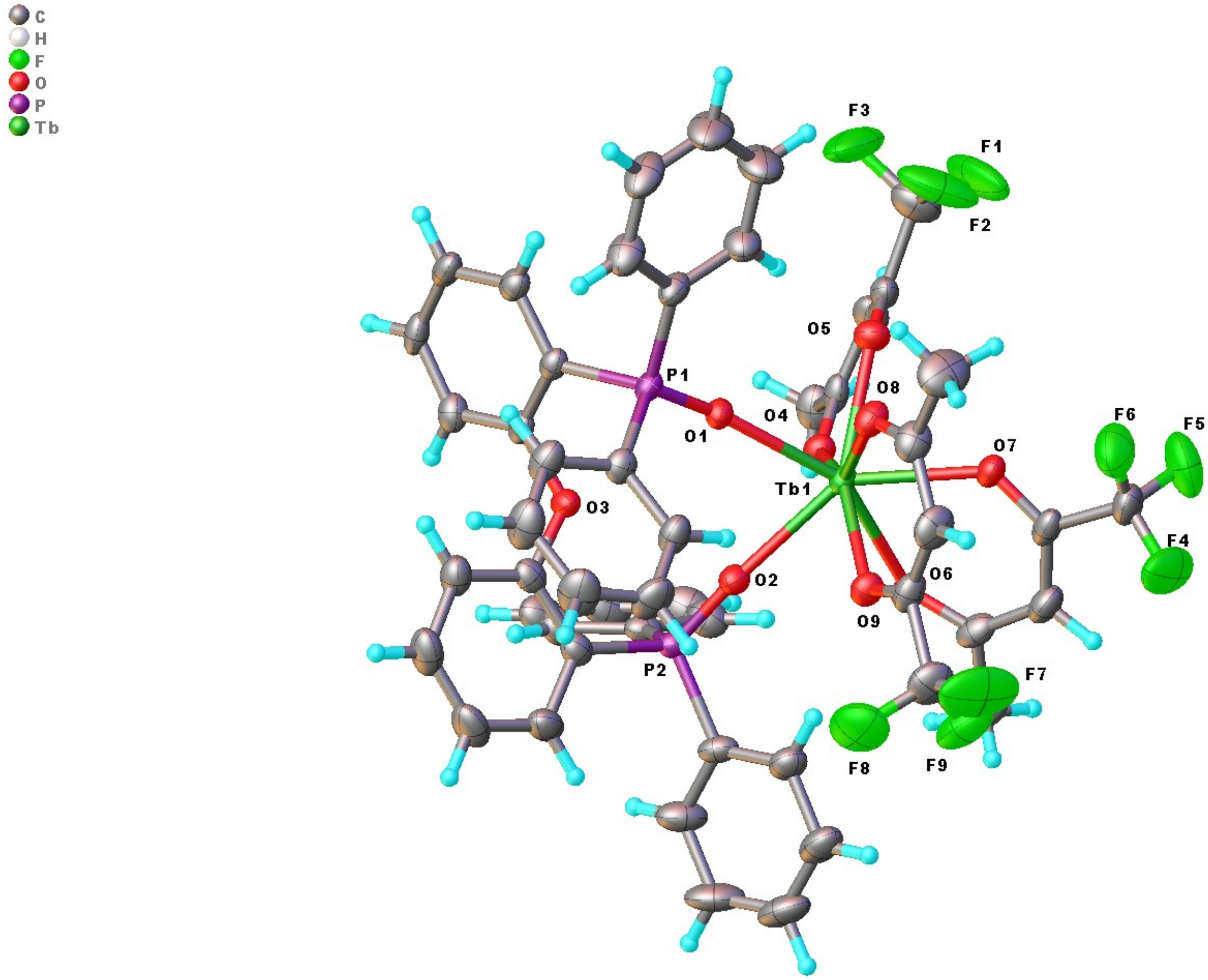

Fig. S 7**.** The molecular structure of **Tb-2** complex.

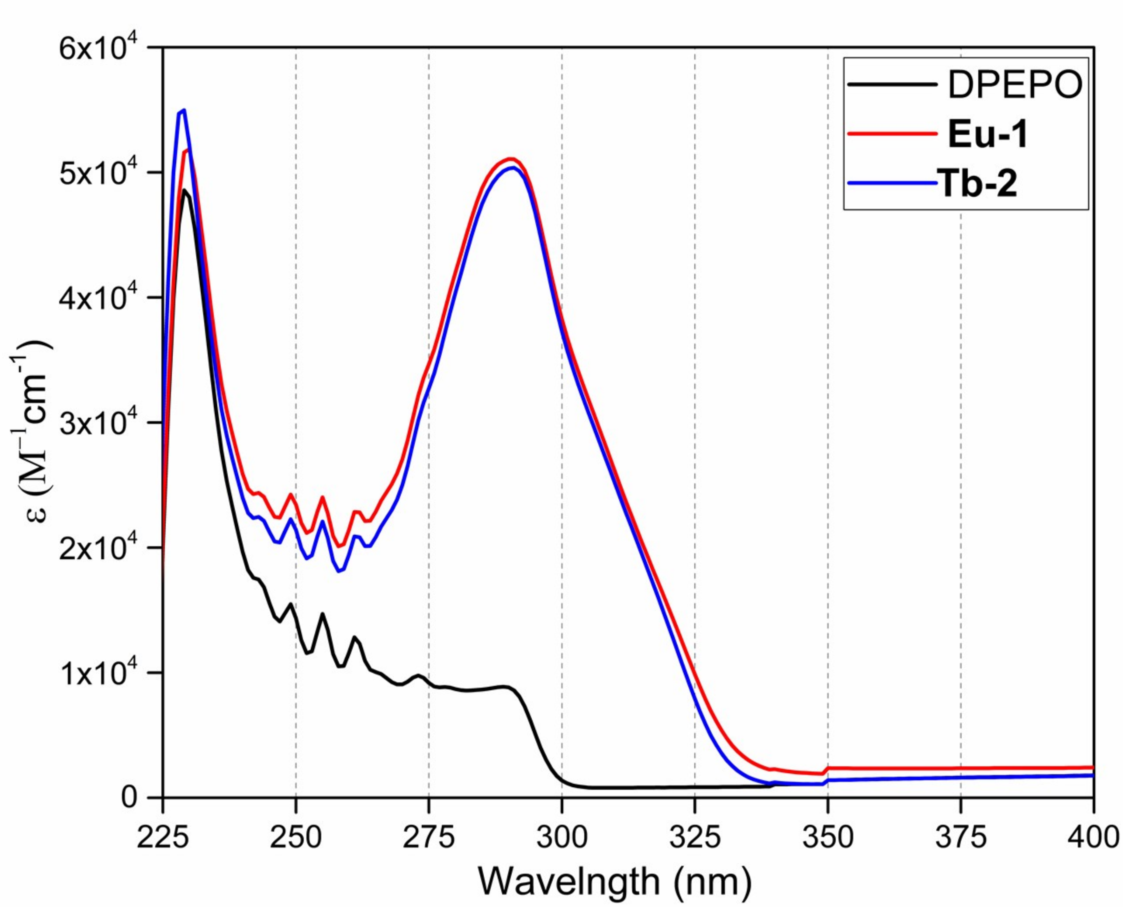

Fig. S 8. Optical absorption spectra of free DPEPO ligand, **Eu-1** and **Tb-2** complex in DCM solution.

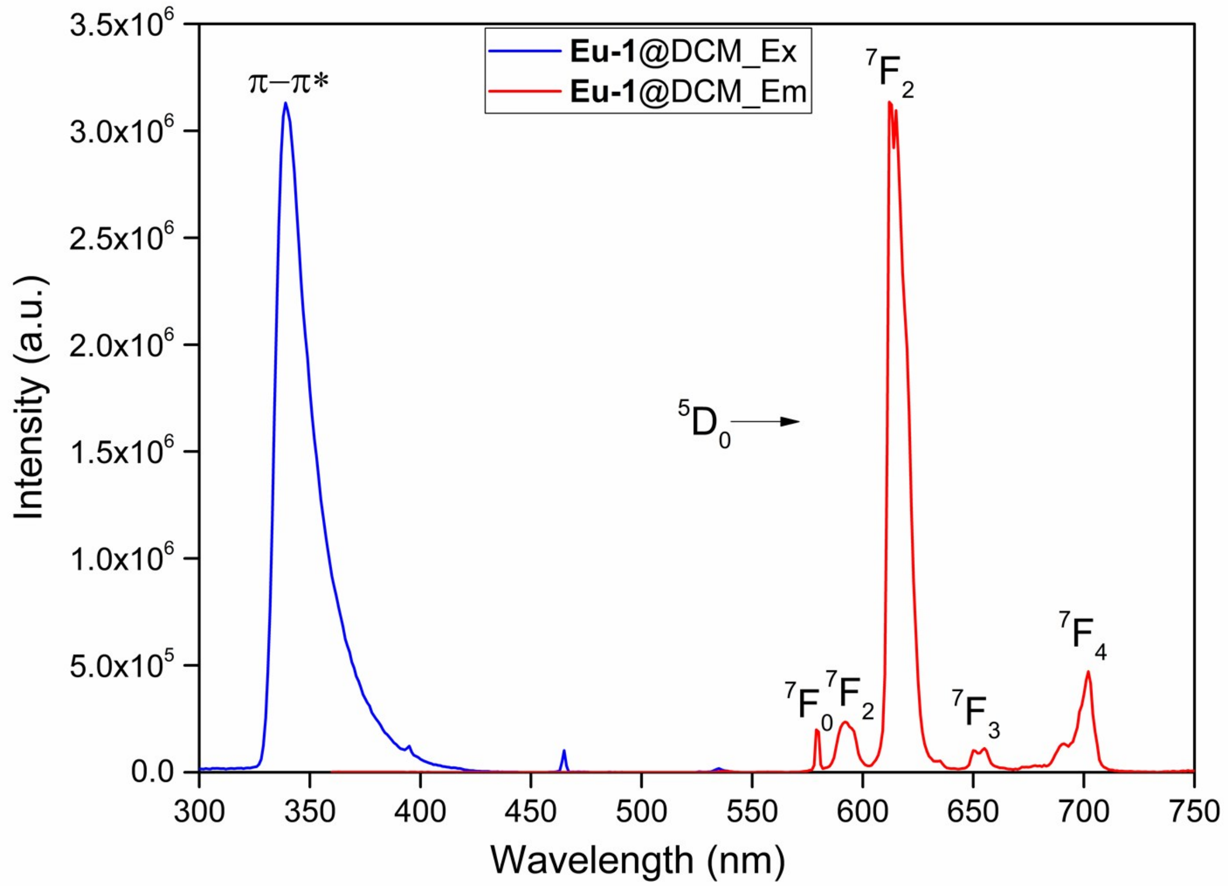

Fig. S 9. Excitation and corrected emission spectra of **Eu-1** in DCM at RT.

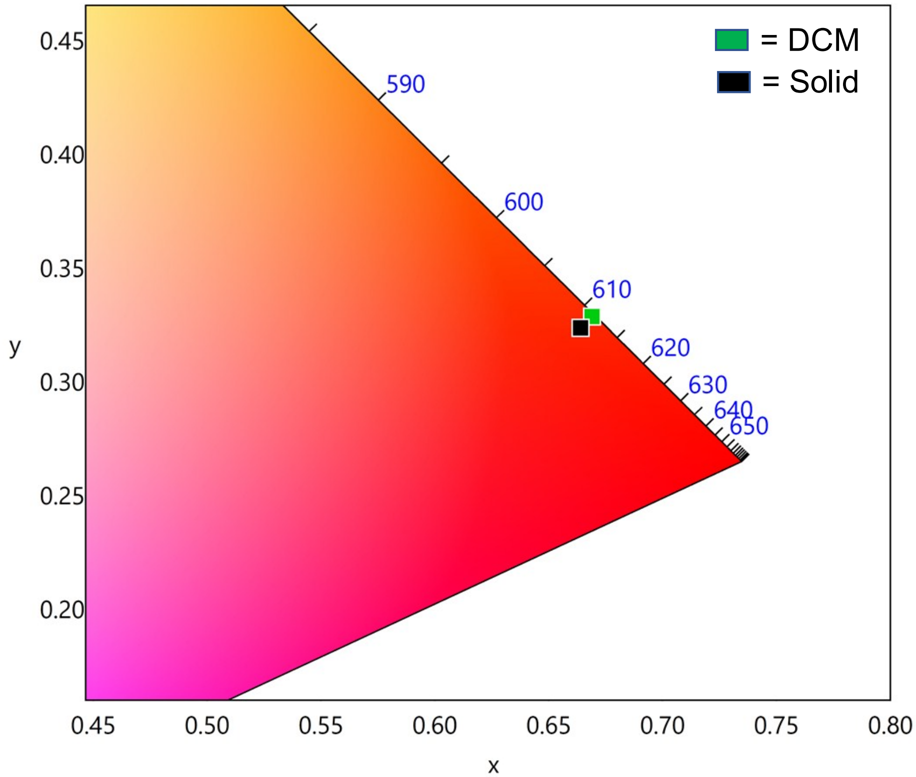

Fig. S 10**.** Magnified view of the 1931 CIE color coordinates of the **Eu-1** in the solid state and in DCM solution at RT.

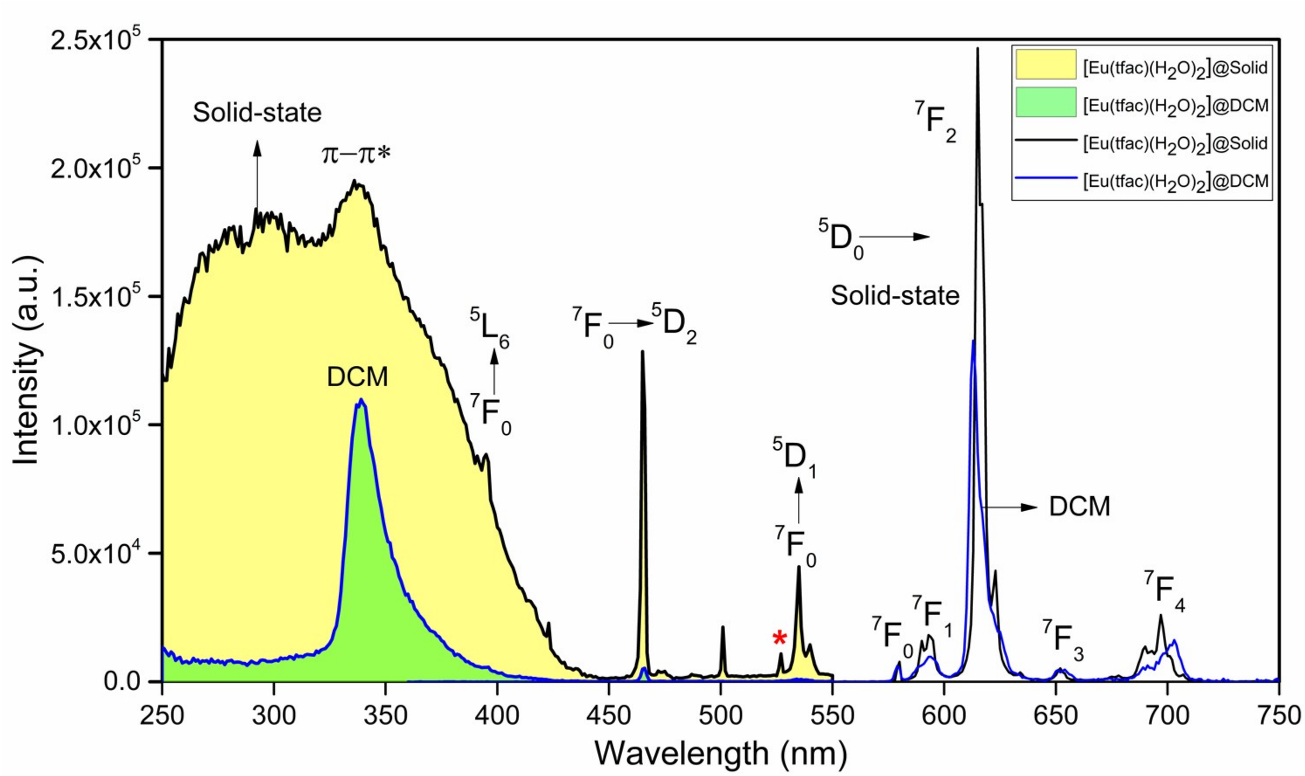

Fig. S 11. Excitation and corrected emission spectra of [$Eu(tfac)_3(H_2O)_2$] in solid-state and in DCM solution at RT.

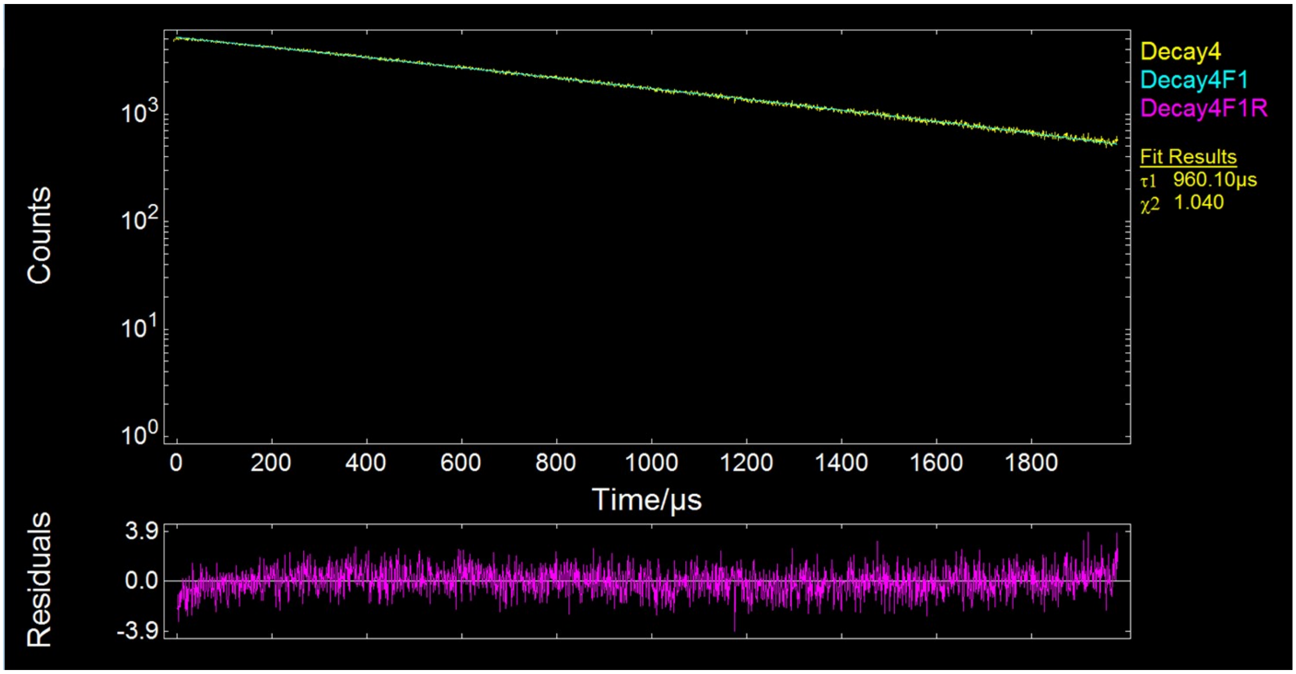

Fig. S 12**.** Experimental decay profile for **Eu-1** complex together with fitted curve in the solid state at RT by exciting it at $\lambda_{\max}^{Ex}$ ≈ 359 nm.

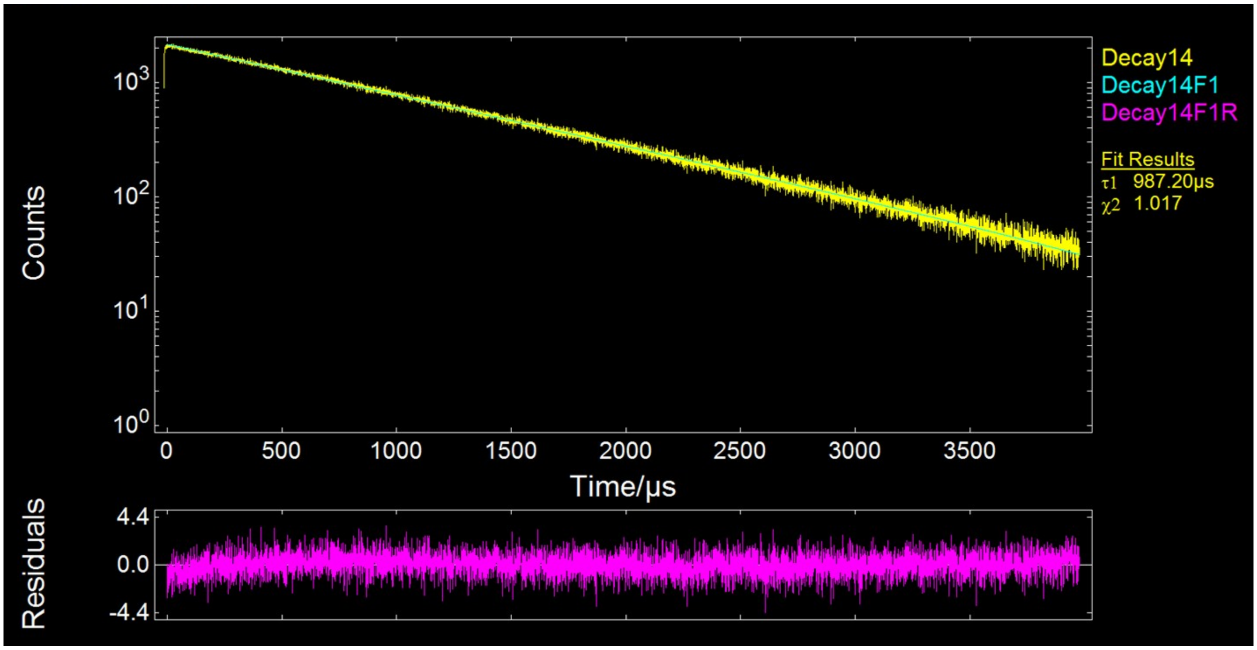

Fig. S 13. Experimental decay profile for **Eu-1** complex together with fitted curve in DCM solution at RT by exciting it at $\lambda_{\max}^{Ex}$ ≈ 340 nm.

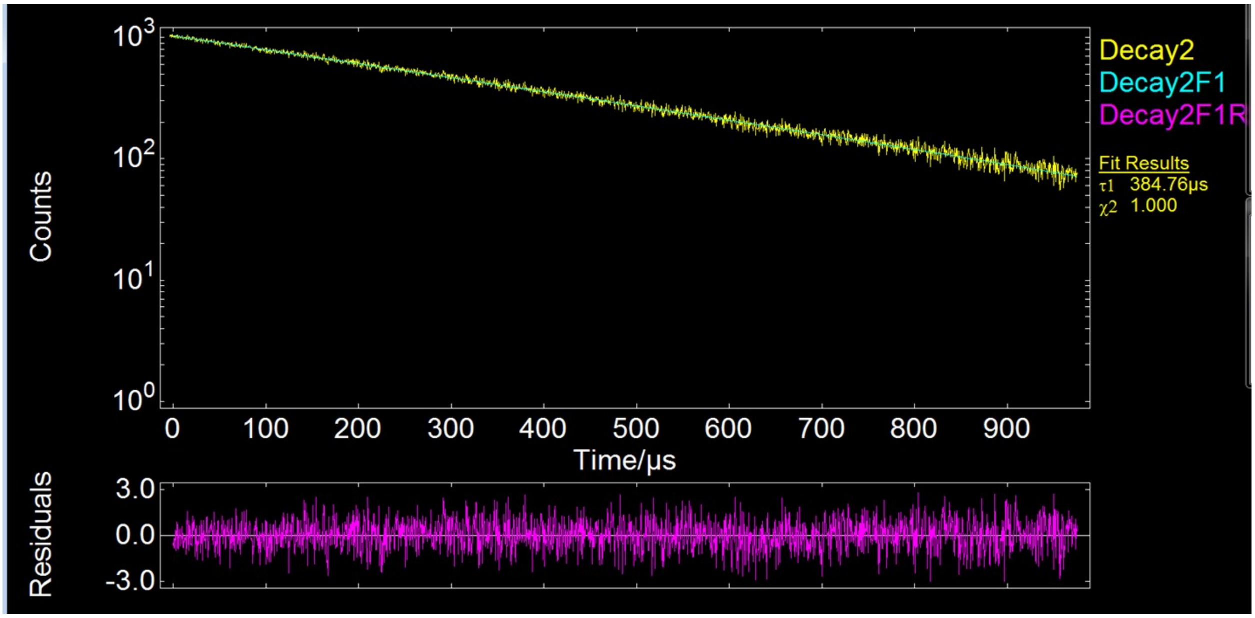

Fig. S 14. Experimental decay profile for $[Eu(tfac)_3(H_2O)_2]$ complex together with fitted curve in the solid-state at RT.

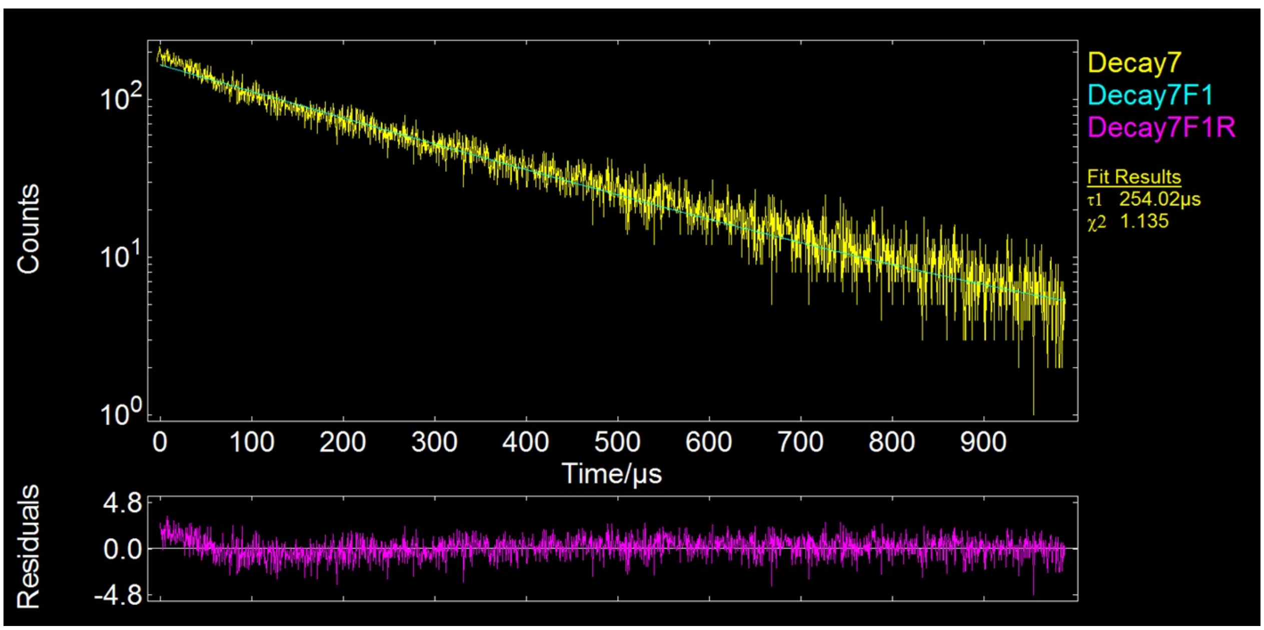

Fig. S 15. Experimental decay profile for $[Eu(tfac)_3(H_2O)_2]$ complex together with fitted curve in DCM at RT.

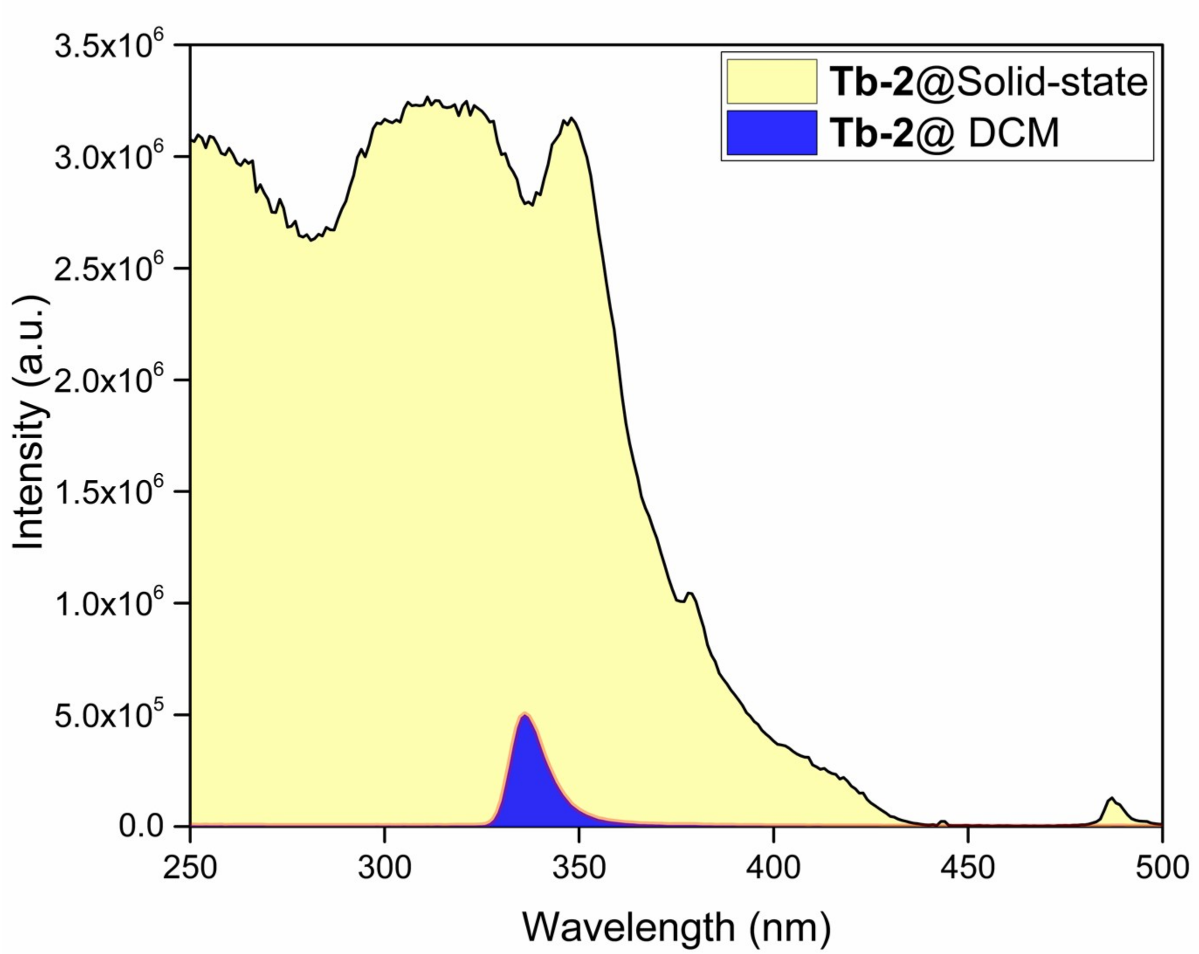

Fig. S 16. Excitation spectra of **Tb-2** complex in the solid-state and in DCM solution at RT.

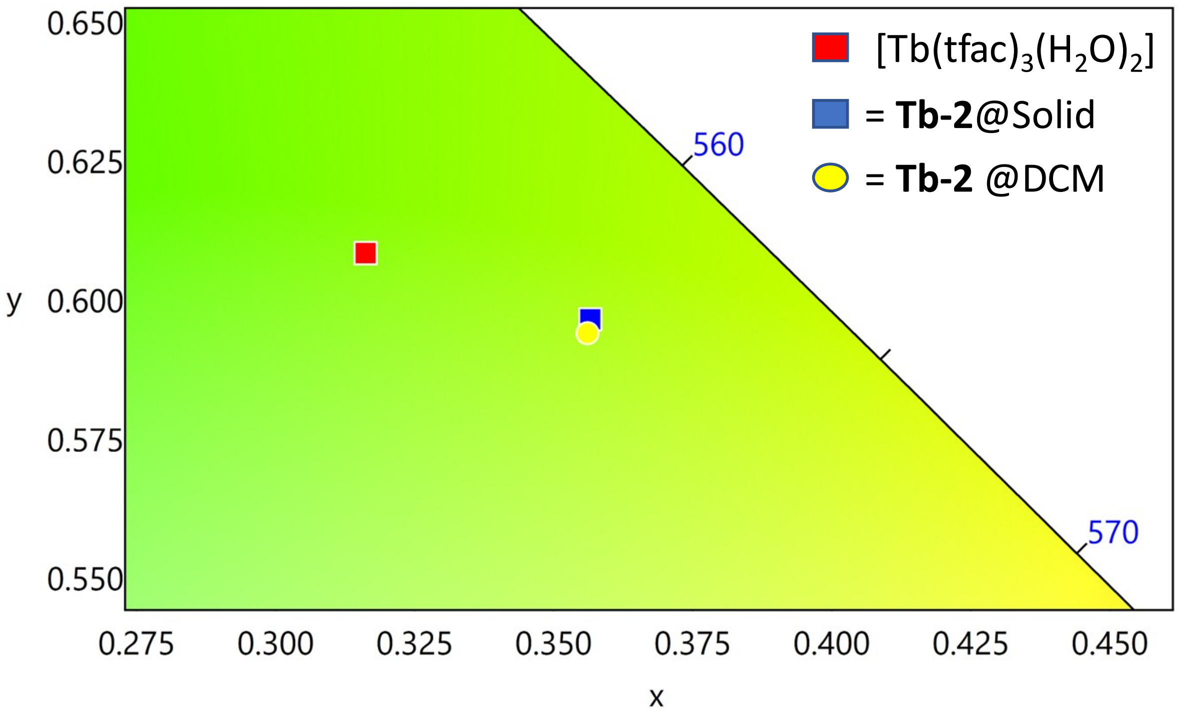

Fig. S 17. Magnified view of the 1931 CIE color coordinates of the $[Tb(tfac)_3(H_2O)_2]$ and **Tb-2** complex at RT.

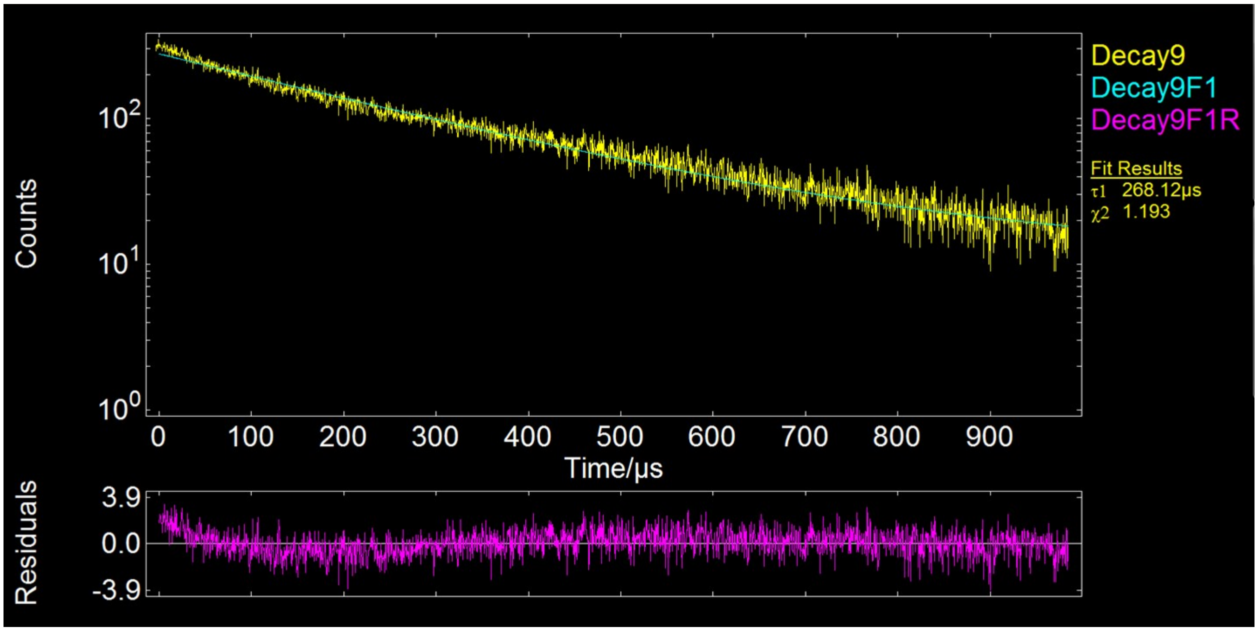

Fig. S 18. Experimental decay profile for **Tb-2** complex together with fitted curve in the solid-state at RT.

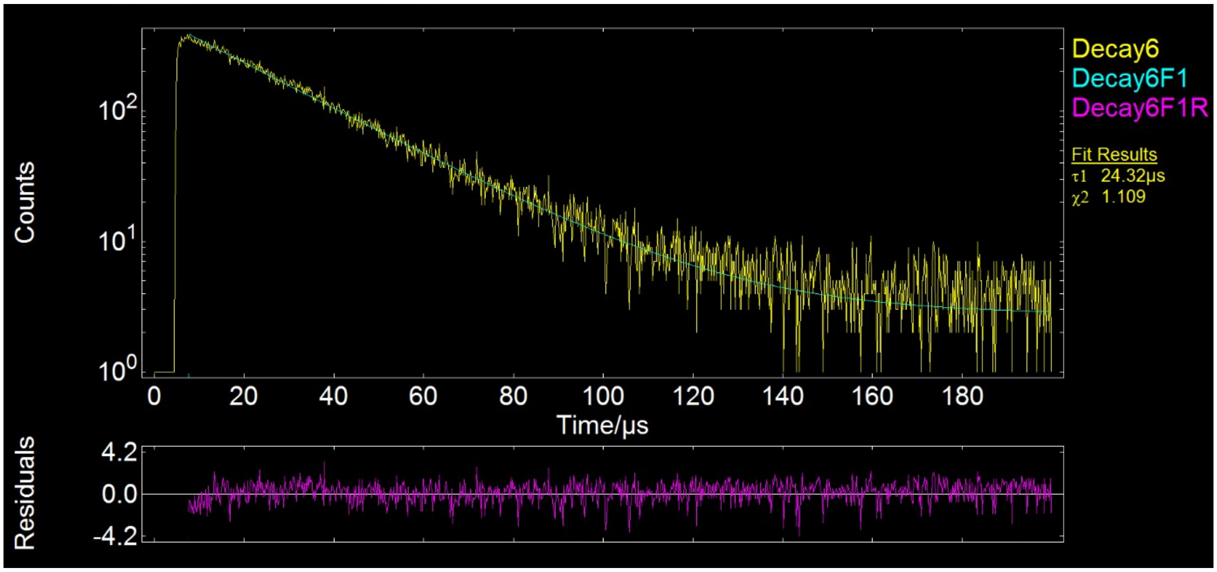

Fig. S 19. Experimental decay profile for **Tb-**2 complex together with fitted curve in DCM solution at RT.

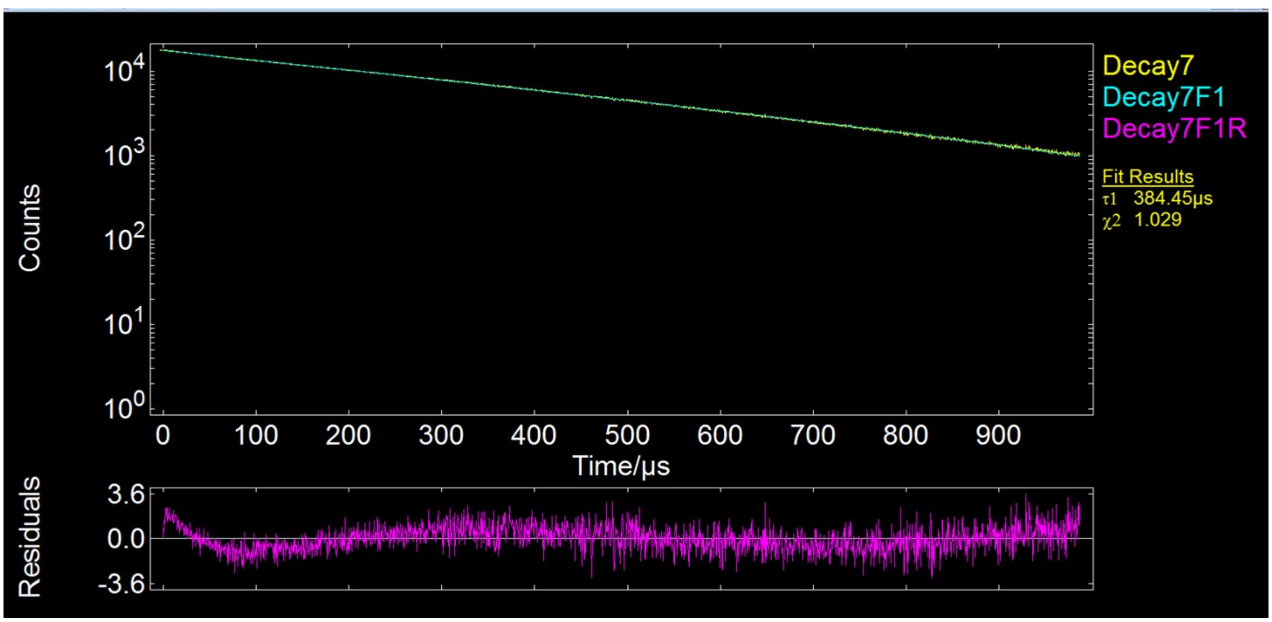

Fig. S 20. Experimental decay profile for $[Tb(tfac)_3(H_2O)_2]$ complex together with fitted curve in the solid-state solution at RT.

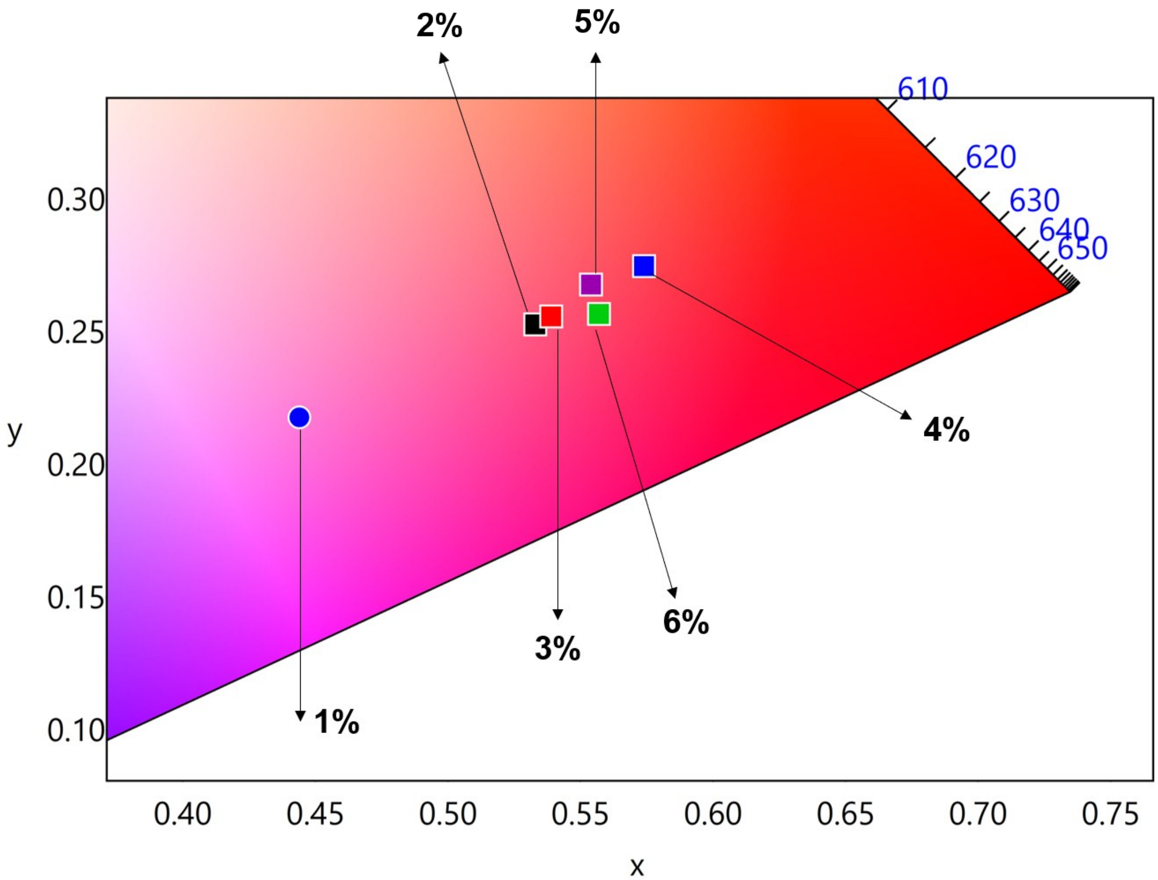

Fig. S 21. A magnified view of the CIE color coordinates at 10 mA/cm^2 of double-EMLs devices with different doping concentration of **Eu-1** complex.

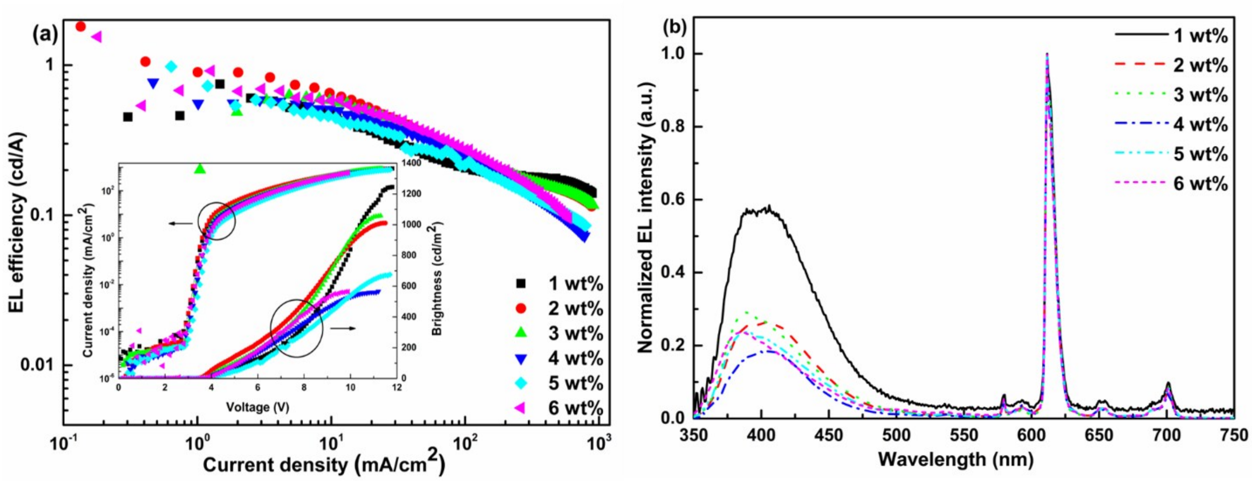

Fig. S 22. **(a)** EL efficiency-current density characteristics of double-EMLs devices with **Eu-1** at different doping concentrations. Inset: Current density-brightness-voltage characteristics of the double-EMLs devices with **Eu-1** at different doping concentrations. **(b)** Normalized EL spectra of the double-EMLs devices with **Eu-1** at different doping concentrations operating at 10 mA cm^{-2}.

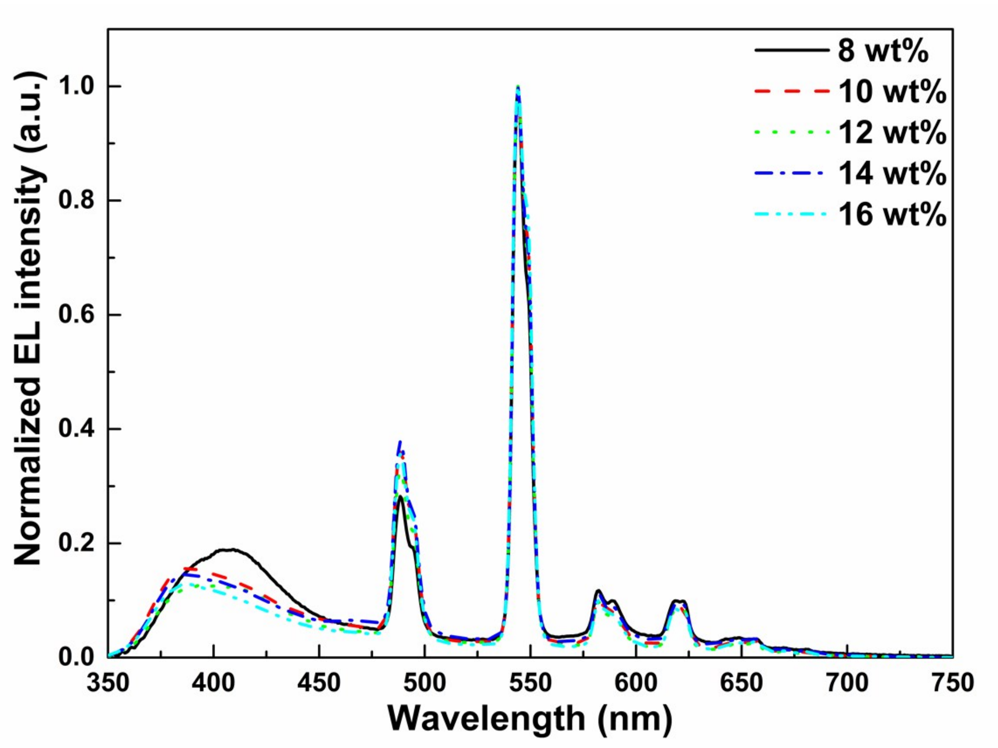

Fig. S 23. Normalized EL spectra of the double-EMLs devices with **Tb-2** at different doping concentrations operating at 10 mA cm^{-2}.

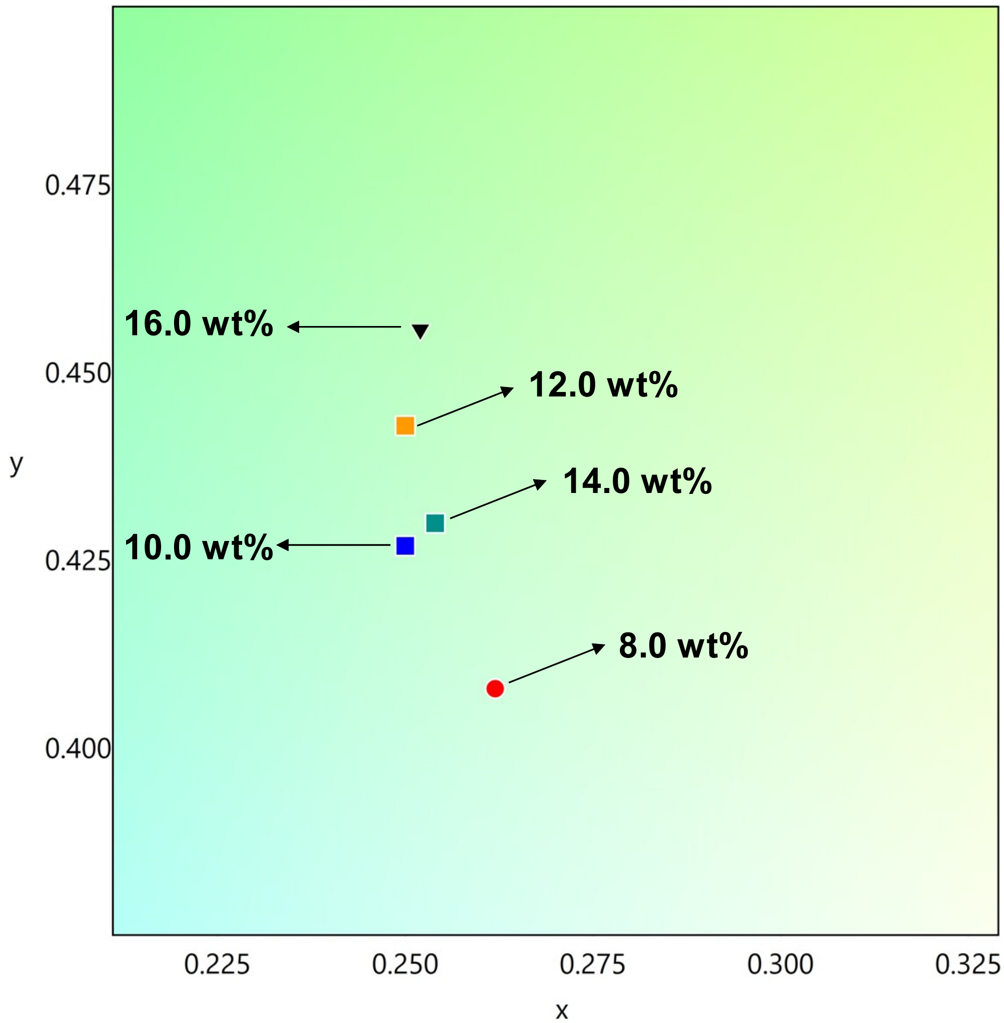

Fig. S 24. A magnified view of the CIE color coordinates at 10 mA/cm^2 of double-EMLs devices with different doping concentration of **Tb-2** complex.

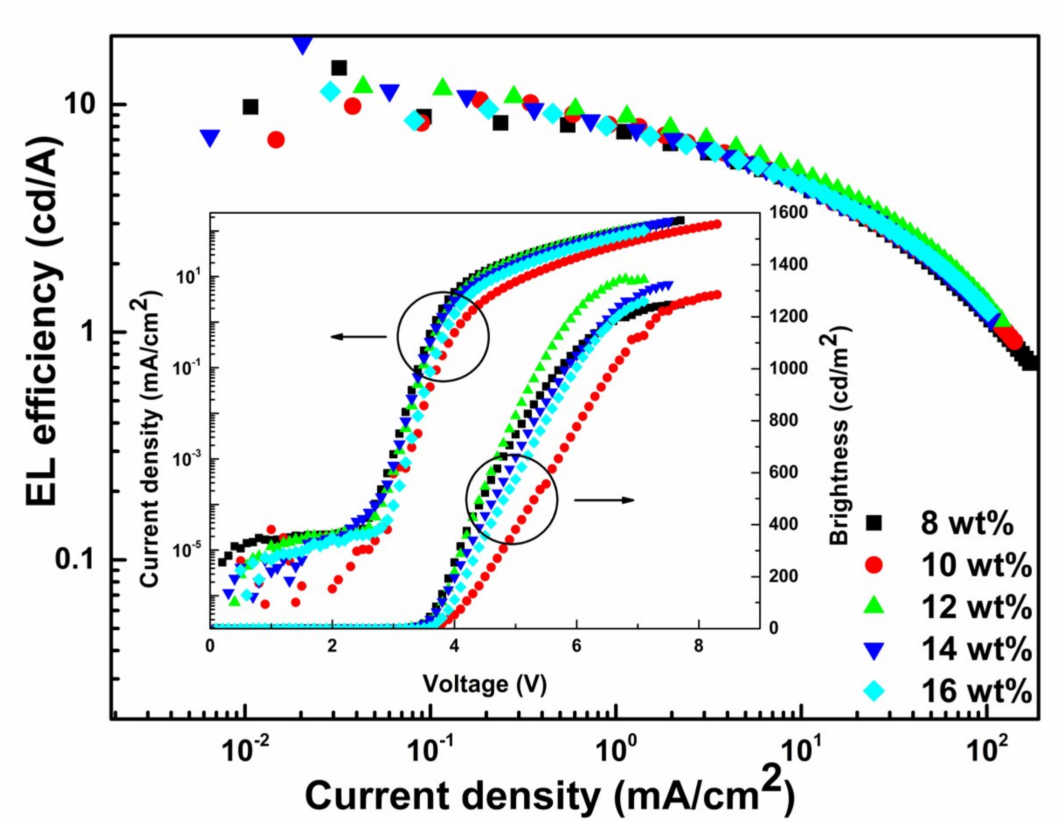

Fig. S 25. EL efficiency-current density characteristics of the double-EMLs devices with Tb-2 at different doping concentrations. Inset: Current density-brightness-voltage characteristics of the single-EML devices with Tb-2 at different doping concentrations.

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