Supporting Information

Towards full-color-tunable emission of two component Eu(III)-doped Gd(III) coordination frameworks by variation of excitation light

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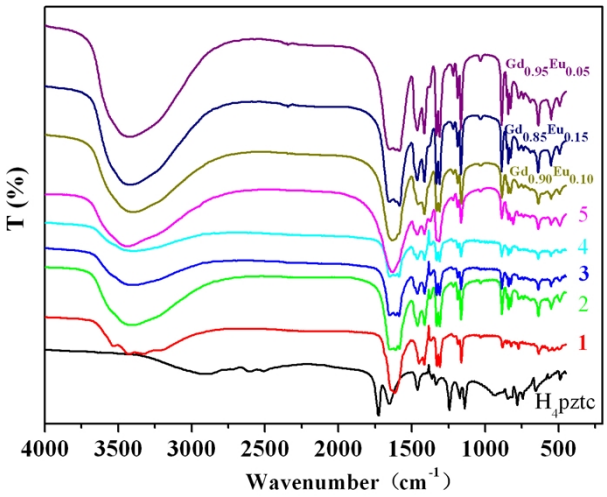

Fig. S1 Infrared spectra of H_4pztc, complexes **1**−**5** and Eu(III)-doped Gd(III) complexes.

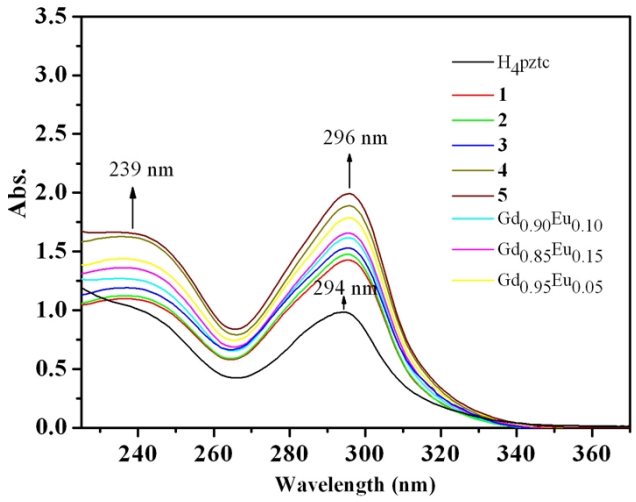

Fig. S2 UV-vis spectra for H_4pztc, complexes **1**−**5** and Eu(III)-doped Gd(III) complexes in aqueous solution.

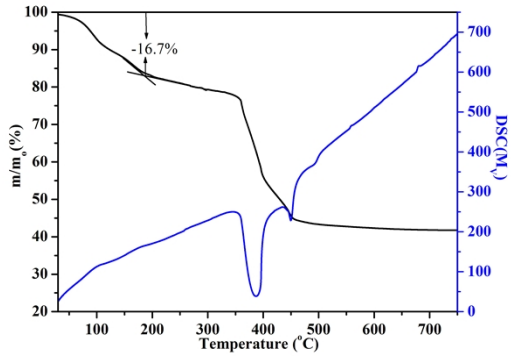

Fig. S3 TG−DSC curves of complex **1**.

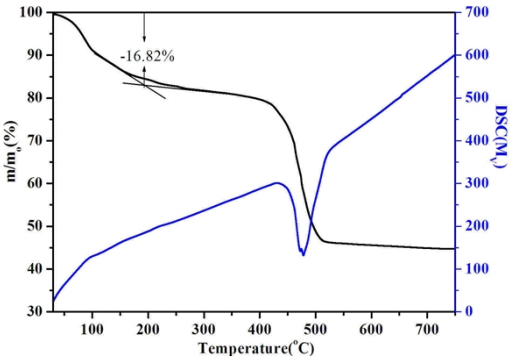

Fig. S4 TG−DSC curves of complex **2**.

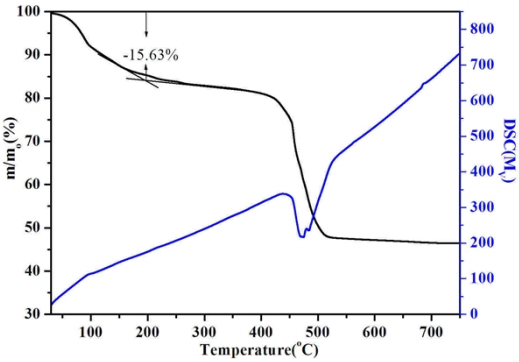

Fig. S5 TG−DSC curves of complex **3**.

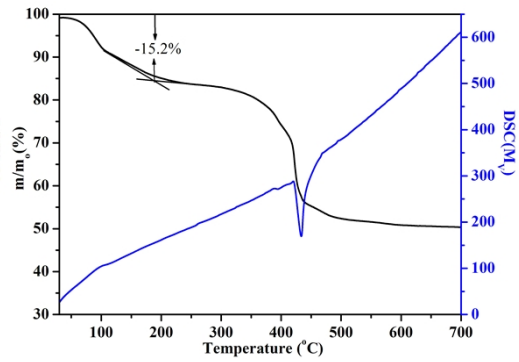

Fig. S6 TG−DSC curves of complex **4**.

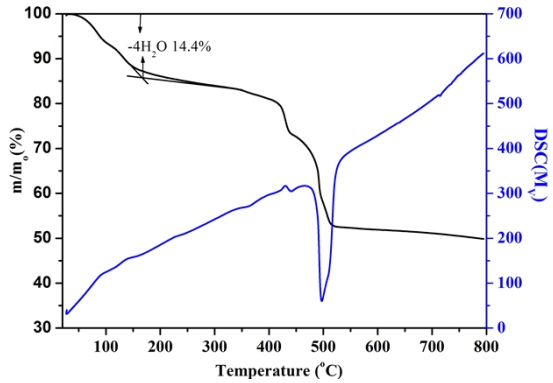

Fig. S7 TG−DSC curves of complex **5**.

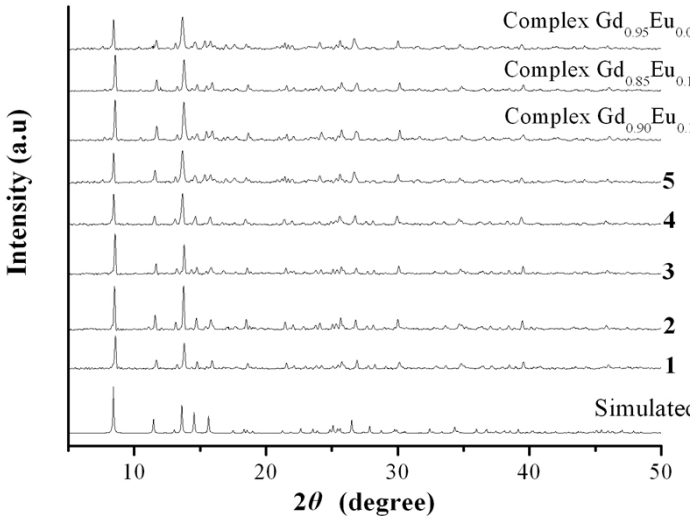

Fig. S8 Experimental X-ray powder patterns for microcrystalline samples **1**–**5**, Eu(III)-doped Gd(III) complexes and simulated pattern.

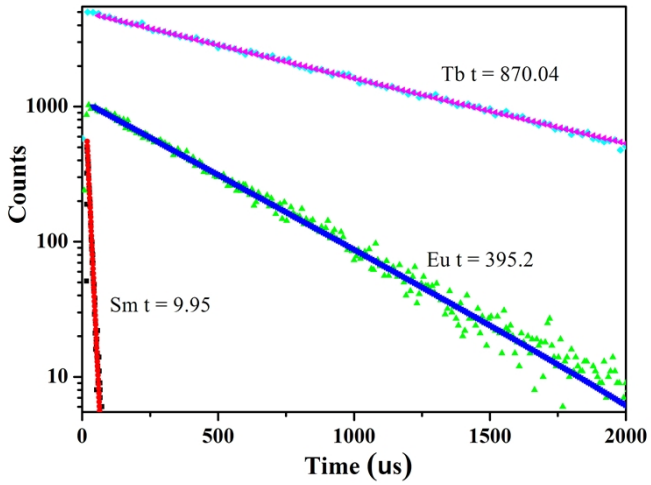

Fig. S9 Luminescence decay profiles for complexes **2**, **3**, and **5**.

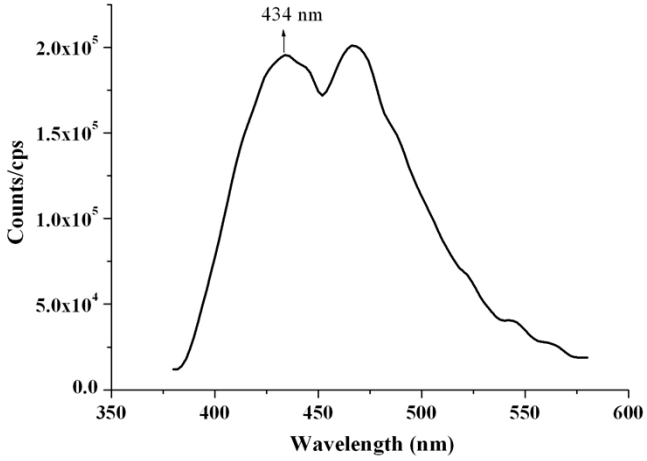

Fig. S10 Phosphorescence spectrum of **4** at 77K

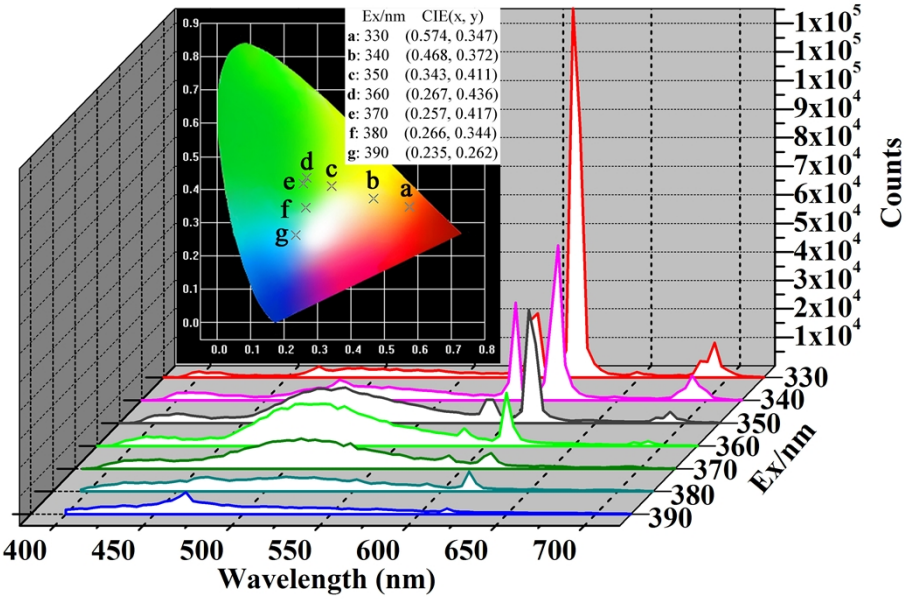

Fig. S11 Solid-state emission spectra of complex $Gd_{0.85}Eu_{0.15}$ with excitation wavelengths varying from 330 to 390 nm. Insert: CIE chromaticity diagram and color coordinates of the complex $Gd_{0.85}Eu_{0.15}$ under excitation wavelengths from 330 to 390 nm.

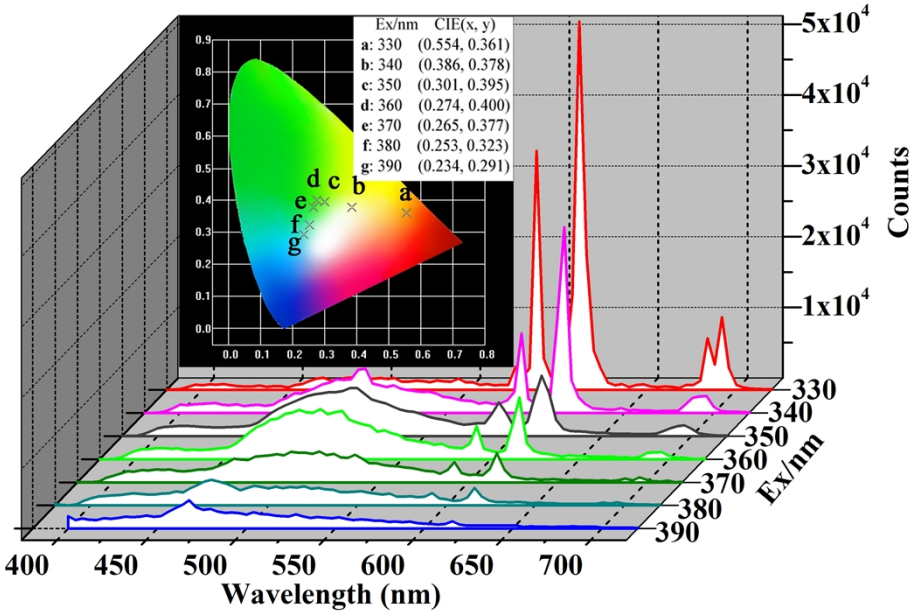

Fig. S12 Solid-state emission spectra of complex $Gd_{0.95}Eu_{0.05}$ with excitation wavelengths varying from 330 to 390 nm. Insert: CIE chromaticity diagram and color coordinates of the complex $Gd_{0.95}Eu_{0.05}$ under excitation wavelengths from 330 to 390 nm.

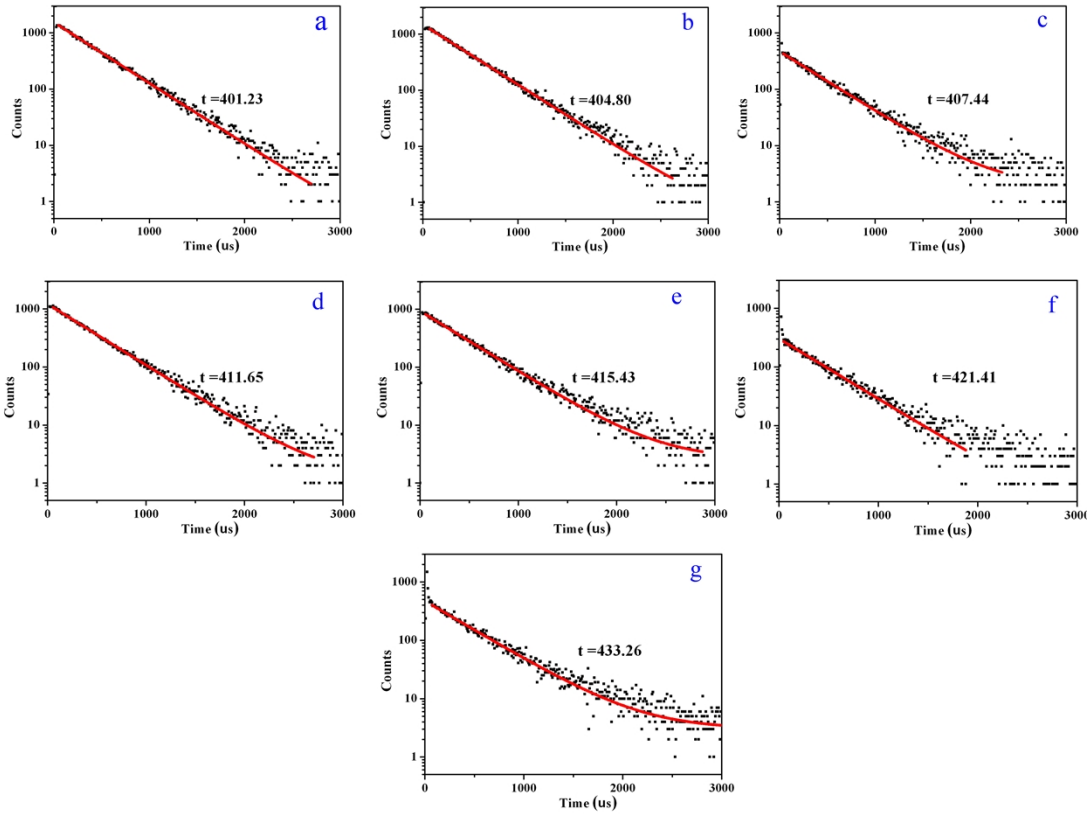

Fig. S13 Luminescence decay profiles for $Gd_{0.90}Eu_{0.10}$ material from 330 to 390 nm (a–g, step size 10 nm).

Table S1 Crystal data and structure refinement for complexes **1**−**5**

Complexes	**1**	**2**	**3**	**4**	**5**
Formula	$C_8N_2H_8O_{12}NaCe$	$C_8N_2H_8O_{12}NaSm$	$C_8N_2H_8O_{12}NaEu$	$C_8N_2H_8O_{12}NaGd$	$C_8N_2H_8O_{12}NaTb$
M/g mol^{-1}	487.27	497.51	499.11	504.40	506.08
Color	Colourless	Colourless	Colourless	Colourless	Colourless
Crystal system	Orthorhombic	Orthorhombic	Orthorhombic	Orthorhombic	Orthorhombic
Space group	*Pnma*	*Pnma*	*Pnma*	*Pnma*	*Pnma*
a (Å)	15.414(3)	15.569(3)	15.306(3)	15.251(3)	15.147(3)
b (Å)	6.7180(13)	6.8533(13)	6.7260(13)	6.6990(13)	6.6763(13)
c (Å)	14.322(3)	14.397(3)	14.386(3)	14.382(3)	14.375(3)
V (Å^3)	1483.1(5)	1536.1(5)	1481.0(5)	1469.4(5)	1453.7(5)
Z	4	4	4	4	4
Dcalcd/g cm^{-3}	2.182	2.151	2.238	2.280	2.312
μ (mm^{-1})	3.167	3.917	4.333	4.612	4.965
F (000)	940	956	960	964	968
R_1 [$I > 2\sigma(I)$]	0.0693	0.0653	0.0695	0.0812	0.0700
wR_2, [$I > 2\sigma(I)$]	0.1897	0.1780	0.1746	0.2114	0.1721
R_1, (all data)	0.0749	0.0707	0.0809	0.0922	0.0774
wR_2, (all date)	0.1954	0.1819	0.1856	0.2219	0.1786
GOF on F^2	1.074	1.119	0.980	1.091	1.074

Table S2 Bond lengths (Å) and angles (deg) for complex **1**

Ce(1)-O(3)#1	2.414(9)	Ce(1)-O(3)#2	2.414(9)
Ce(1)-O(1)	2.417(11)	Ce(1)-O(6)	2.430(16)
Ce(1)-O(8)#3	2.440(18)	Ce(1)-O(8)	2.440(18)
Ce(1)-N(1)	2.549(11)	Ce(1)-O(4)#4	2.572(9)
Ce(1)-O(4)#5	2.572(9)		
N(1)-Ce(1)-O(4)#4	133.0(4)	O(3)#1-Ce(1)-O(6)	73.5(3)
O(1)-Ce(1)-N(1)	63.5(3)	O(3)#1-Ce(1)-O(8)	147.8(6)
O(1)-Ce(1)-O(4)#4	146.4(4)	O(3)#1-Ce(1)-O(8)#3	70.6(6)
O(1)-Ce(1)-O(6)	126.3(4)	O(3)#2-Ce(1)-O(4)#4	121.4(3)
O(1)-Ce(1)-O(8)	75.0(5)	O(4)#4-Ce(1)-O(4)#5	51.1(4)
O(3)#1-Ce(1)-N(1)	71.9(3)	O(6)-Ce(1)-N(1)	62.7(4)
O(3)#1-Ce(1)-O(1)	90.3(2)	O(6)-Ce(1)-O(4)#4	77.7(5)
O(3)#1-Ce(1)-O(3)#2	139.1(6)	O(6)-Ce(1)-O(8)	138.1(5)
O(3)#1-Ce(1)-O(4)#4	73.3(3)	O(8)#3-Ce(1)-O(8)	77.9(10)
O(8)-Ce(1)-O(4)#4	103.4(6)	O(8)-Ce(1)-N(1)	122.8(5)
O(8)-Ce(1)-O(4)#5	71.9(6)		

Symmetry transformations used to generate equivalent atoms: #1: − x, y + 1/2, − z + 1; #2: − x, − y − 1, − z + 1; #3: x, − y − 1/2, z; #4: x − 1/2, − y − 1/2, − z + 3/2; #5: x − 1/2, y, − z + 3/2.

Table S3 Bond lengths (Å) and angles (deg) for complex **2**

Sm(1)-O(3)#1	2.468(7)	Sm(1)-O(8)	2.529(15)
Sm(1)-O(3)#2	2.468(7)	Sm(1)-O(4)#4	2.614(7)
Sm(1)-O(1)	2.474(9)	Sm(1)-O(4)#5	2.614(7)
Sm(1)-O(6)	2.514(14)	Sm(1)-N(1)	2.620(8)
Sm(1)-O(8)#3	2.529(15)		
O(8)-Sm(1)-O(4)#4	102.9(5)	O(1)-Sm(1)-N(1)	62.0(3)
O(3)#1-Sm(1)-O(4)#4	120.3(3)	O(3)#1-Sm(1)-O(8)	71.0(5)
O(1)-Sm(1)-O(6)	122.8(3)	O(3)#1-Sm(1)-N(1)	72.48(19)
O(8)-Sm(1)-N(1)	124.0(5)	O(8)-Sm(1)-O(4)#5	73.3(6)
O(4)#4-Sm(1)-N(1)	132.1(3)	O(3)#1-Sm(1)-O(4)#5	73.7(2)
O(6)-Sm(1)-O(8)	139.5(5)	O(3)#1-Sm(1)-O(6)	74.0(3)
O(3)#1-Sm(1)-O(3)#2	140.8(5)	O(8)#3-Sm(1)-O(8)	75.5(9)
O(3)#1-Sm(1)-O(8)#3	145.9(5)	O(1)-Sm(1)-O(8)	76.7(5)
O(1)-Sm(1)-O(4)#4	149.0(3)	O(6)-Sm(1)-O(4)#4	77.9(4)
O(4)#4-Sm(1)-O(4)#5	49.3(4)	O(3)#1-Sm(1)-O(1)	89.38(18)
O(6)-Sm(1)-N(1)	60.9(3)		

Symmetry transformations used to generate equivalent atoms: #1: − x, y + 1/2, − z + 1; #2: − x, − y − 1, − z + 1; #3: x, − y − 1/2, z; #4: x − 1/2, − y − 1/2, − z + 3/2; #5: x − 1/2, y, − z + 3/2.

Table S4 Bond lengths (Å) and angles (deg) for complex **3**

Eu(1)-O(1)	2.393(11)	Eu(1)-O(3)#1	2.406(9)
Eu(1)-O(3)#2	2.406(9)	Eu(1)-O(6)	2.415(18)
Eu(1)-O(8)#3	2.45(2)	Eu(1)-O(8)	2.45(2)
Eu(1)-N(1)	2.552(11)	Eu(1)-O(4)#4	2.563(10)
Eu(1)-O(4)#5	2.563(10)		
O(8)-Eu(1)-O(4)#5	103.4(7)	O(1)-Eu(1)-N(1)	63.7(3)
O(3)#1-Eu(1)-O(4)#5	121.5(4)	O(3)#1-Eu(1)-O(8)	70.3(7)
O(8)-Eu(1)-N(1)	123.8(6)	O(8)-Eu(1)-O(4)#4	72.1(7)
O(1)-Eu(1)-O(6)	127.2(4)	O(3)#1-Eu(1)-N(1)	72.3(3)
N(1)-Eu(1)-O(4)#4	131.9(4)	O(3)#1-Eu(1)-O(4)#4	73.0(3)
O(6)-Eu(1)-O(8)	137.9(7)	O(3)#1-Eu(1)-O(6)	74.6(4)
O(3)#1-Eu(1)-O(3)#2	140.7(7)	O(1)-Eu(1)-O(8)	75.7(7)
O(3)#1-Eu(1)-O(8)#3	146.5(8)	O(6)-Eu(1)-O(4)#4	75.8(5)
O(1)-Eu(1)-O(4)#4	147.0(3)	O(8)#3-Eu(1)-O(8)	76.9(13)
O(4)#4-Eu(1)-O(4)#5	51.3(5)	O(1)-Eu(1)-O(3)#1	89.7(3)
O(6)-Eu(1)-N(1)	63.5(4)		

Symmetry transformations used to generate equivalent atoms: #1: − x, y + 1/2, − z + 1; #2: − x, − y − 1, − z + 1; #3: x, − y − 1/2, z; #4: x − 1/2, y, − z + 3/2; #5: x − 1/2, − y − 1/2, − z + 3/2.

Table S5 Bond lengths (Å) and angles (deg) for complex **4**

Gd(1)-O(1)	2.385(15)	Gd(1)-O(8)	2.43(3)
Gd(1)-O(6)	2.39(2)	Gd(1)-N(1)	2.533(13)
Gd(1)-O(3)#1	2.395(11)	Gd(1)-O(4)#4	2.558(12)
Gd(1)-O(3)#2	2.395(11)	Gd(1)-O(4)#5	2.558(12)
Gd(1)-O(8)#3	2.43(3)		
O(8)-Gd(1)-O(4)#4	103.1(7)	O(1)-Gd(1)-N(1)	63.8(4)
O(3)#1-Gd(1)-O(4)#4	122.1(4)	O(3)#1-Gd(1)-O(8)	71.0(8)
O(8)-Gd(1)-N(1)	123.9(7)	O(8)-Gd(1)-O(4)#5	71.6(7)
O(1)-Gd(1)-O(6)	127.1(6)	O(3)#1-Gd(1)-N(1)	71.7(3)
N(1)-Gd(1)-O(4)#4	132.1(4)	O(3)#1-Gd(1)-O(4)#5	73.3(4)
O(6)-Gd(1)-O(8)	137.9(8)	O(6)-Gd(1)-O(3)#1	74.2(4)
O(3)#1-Gd(1)-O(3)#2	139.4(7)	O(1)-Gd(1)-O(8)	75.7(7)
O(1)-Gd(1)-O(4)#4	146.5(4)	O(6)-Gd(1)-O(4)#4	76.4(6)
O(3)#2-Gd(1)-O(8)	147.1(9)	O(8)#3-Gd(1)-O(8)	76.8(15)
O(4)#4-Gd(1)-O(4)#5	51.8(6)	O(1)-Gd(1)-O(3)#1	89.6(3)
O(6)-Gd(1)-N(1)	63.4(5)		

Symmetry transformations used to generate equivalent atoms: #1: − x, y + 1/2, − z + 1; #2: − x, − y − 1, − z + 1; #3: x, − y − 1/2, z; #4: x − 1/2, − y − 1/2, − z + 3/2; #5: x − 1/2, y, − z + 3/2.

Table S6 Bond lengths (Å) and angles (deg) for complex **5**

Tb(1)-O(1)	2.366(13)	Tb(1)-O(3)#1	2.377(10)
Tb(1)-O(3)#2	2.377(10)	Tb(1)-O(6)	2.387(19)
Tb(1)-O(8)#3	2.40(2)	Tb(1)-O(8)	2.40(2)
Tb(1)-N(1)	2.517(12)	Tb(1)-O(4)#4	2.538(11)
Tb(1)-O(4)#5	2.538(11)		
O(8)-Tb(1)-O(4)#4	101.5(7)	O(1)-Tb(1)-N(1)	64.1(4)
O(3)#1-Tb(1)-O(4)#4	122.1(4)	O(8)-Tb(1)-O(4)#5	70.1(7)
O(8)-Tb(1)-N(1)	125.3(6)	O(3)#1-Tb(1)-O(8)	71.2(7)
O(1)-Tb(1)-O(6)	128.0(5)	O(3)#1-Tb(1)-N(1)	71.9(3)
N(1)-Tb(1)-O(4)#4	132.3(4)	O(3)#1-Tb(1)-O(4)#5	73.2(4)
O(6)-Tb(1)-O(8)	137.1(7)	O(3)#1-Tb(1)-O(6)	74.4(3)
O(3)#1-Tb(1)-O(3)#2	139.8(6)	O(6)-Tb(1)-O(4)#4	76.1(5)
O(1)-Tb(1)-O(4)#4	146.2(4)	O(8)#3-Tb(1)-O(8)	76.3(13)
O(3)#1-Tb(1)-O(8)#3	147.0(8)	O(1)-Tb(1)-O(8)	76.8(6)
O(4)#4-Tb(1)-O(4)#5	51.8(5)	O(1)-Tb(1)-O(3)#1	89.9(3)
O(6)-Tb(1)-N(1)	63.9(5)		

Symmetry transformations used to generate equivalent atoms: #1: − x, y + 1/2, − z + 1; #2: − x, − y − 1, − z + 1; #3: x, –y − 1/2, z; #4: x − 1/2, –y − 1/2, − z + 3/2; #5: x − 1/2, y, − z + 3/2.