Synthesis, luminescent and magnetic properties of tetranuclear lanthanide-based (Eu_4, Gd_4 and Dy_4) clusters

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Table S1 Selected bond lengths (Å) and angles (°) for complex 1

Eu(1)-O(1)#1	2.457(7)	Eu(2)-O(1)	2.416(7)
Eu(1)-O(3)	2.406(7)	Eu(2)-O(3)	2.446(7)
Eu(1)-O(7)	2.367(7)	Eu(2)-O(5)	2.356(7)
Eu(1)-O(2)	2.411(7)	Eu(2)-O(4)	2.335(7)
Eu(1)-O(6)	2.351(7)	Eu(2)-O(2)	2.401(7)
Eu(1)-N(4)	2.550(9)	Eu(2)-N(2)	2.567(8)
Eu(1)-N(6)	2.605(9)	Eu(2)-O(8)#1	2.401(7)
Eu(1)-O(8)	2.346(7)	Eu(2)-O(8)	2.470(7)
Eu(3)-O(16)	2.338(7)	Eu(4)-O(16)	2.467(7)
Eu(3)-O(10)	2.426(7)	Eu(4)-O(16)#2	2.371(7)
Eu(3)-O(13)	2.331(7)	Eu(4)-O(10)#2	2.400(7)
Eu(3)-O(11)	2.419(7)	Eu(4)-O(11)	2.424(7)
Eu(3)-O(12)	2.351(7)	Eu(4)-O(9)	2.451(7)
Eu(3)-O(9)	2.413(7)	Eu(4)-O(14)	2.326(8)
Eu(3)-N(12)	2.585(9)	Eu(4)-O(15)	2.348(7)
Eu(3)-N(8)	2.595(1)	Eu(4)-N(10)#2	2.570(9)
O(1)-Eu(2)-O(3)	143.8(2)	O(16)#2-Eu(4)-O(16)	72.5(3)
O(1)-Eu(2)-N(2)	65.8(2)	O(16)#2-Eu(4)-O(10)#2	69.5(2)
O(1)-Eu(2)-O(8)	101.2(2)	O(16)#2-Eu(4)-O(11)	77.1(2)
O(3)-Eu(2)-N(2)	78.1(2)	O(16)#2-Eu(4)-O(9)	133.4(2)
O(3)-Eu(2)-O(8)	69.7(2)	O(16)#2-Eu(4)-N(10)#2	115.0(3)
O(5)-Eu(2)-O(1)	82.0(3)	O(16)-Eu(4)-N(10)#2	74.2(2)
O(5)-Eu(2)-O(3)	84.5(2)	O(10)#2-Eu(4)-O(16)	102.6(2)
O(5)-Eu(2)-O(2)	126.2(3)	O(10)#2-Eu(4)-O(11)	146.4(2)
O(5)-Eu(2)-N(2)	72.7(3)	O(10)#2-Eu(4)-O(9)	144.1(2)
O(5)-Eu(2)-O(8)	140.3(2)	O(10)#2-Eu(4)-N(10)#2	65.7(2)
O(5)-Eu(2)-O(8)#1	142.6(2)	O(11)-Eu(4)-O(16)	70.3(2)
O(4)-Eu(2)-O(1)	86.9(2)	O(11)-Eu(4)-O(9)	65.8(2)
O(4)-Eu(2)-O(3)	120.1(2)	O(11)-Eu(4)-N(10)#2	136.4(3)

O(4)-Eu(2)-O(5)	71.3(2)	O(9)-Eu(4)-O(16)	69.1(3)
O(4)-Eu(2)-O(2)	85.7(2)	O(9)-Eu(4)-N(10)#2	78.6(3)
O(4)-Eu(2)-N(2)	137.2(2)	O(14)-Eu(4)-O(16)#2	140.5(3)
O(4)-Eu(2)-O(8)	147.8(2)	O(14)-Eu(4)-O(16)	141.8(2)
O(4)-Eu(2)-O(8)#1	82.8(2)	O(14)-Eu(4)-O(10)#2	81.2(3)
O(2)-Eu(2)-O(1)	146.0(2)	O(14)-Eu(4)-O(11)	125.3(3)
O(2)-Eu(2)-O(3)	65.9(2)	O(14)-Eu(4)-O(9)	85.6(3)
O(2)-Eu(2)-N(2)	135.2(2)	O(14)-Eu(4)-O(15)	71.9(2)
O(2)-Eu(2)-O(8)#1	76.4(2)	O(14)-Eu(4)-N(10)#2	73.1(3)
O(2)-Eu(2)-O(8)	70.2(2)	O(15)-Eu(4)-O(16)	145.3(2)
O(8)#1-Eu(2)-O(1)	69.8(2)	O(15)-Eu(4)-O(16)#2	81.2(3)
O(8)#1-Eu(2)-O(3)	132.6(2)	O(15)-Eu(4)-O(10)#2	88.5(3)
O(8)#1-Eu(2)-N(2)	114.4(2)	O(15)-Eu(4)-O(11)	82.2(2)
O(8)-Eu(2)-N(2)	72.9(2)	O(15)-Eu(4)-O(9)	118.7(3)
O(8)#1-Eu(2)-O(8)	71.3(3)	O(15)-Eu(4)-N(10)#2	139.1(2)
O(1)#1-Eu(1)-N(4)	79.9(3)	O(16)-Eu(3)-O(10)	69.6(2)
O(1)#1-Eu(1)-N(6)	157.0(2)	O(16)-Eu(3)-O(11)	72.6(2)
O(3)-Eu(1)-O(1)#1	133.8(2)	O(16)-Eu(3)-O(12)	79.9(2)
O(3)-Eu(1)-O(2)	66.3(2)	O(16)-Eu(3)-O(9)	71.9(3)
O(3)-Eu(1)-N(4)	107.9(3)	O(16)-Eu(3)-N(12)	133.0(3)
O(3)-Eu(1)-N(6)	65.1(3)	O(16)-Eu(3)-N(8)	132.2(3)
O(7)-Eu(1)-O(1)#1	118.7(2)	O(10)-Eu(3)-N(12)	82.2(3)
O(7)-Eu(1)-O(3)	80.8(2)	O(10)-Eu(3)-N(8)	158.2(3)
O(7)-Eu(1)-O(2)	142.8(2)	O(13)-Eu(3)-O(16)	127.6(3)
O(7)-Eu(1)-N(4)	145.7(3)	O(13)-Eu(3)-O(10)	83.4(2)
O(7)-Eu(1)-N(6)	72.5(3)	O(13)-Eu(3)-O(11)	144.5(2)
O(2)-Eu(1)-O(1)#1	77.2(2)	O(13)-Eu(3)-O(12)	72.9(3)
O(2)-Eu(1)-N(4)	65.7(3)	O(13)-Eu(3)-O(9)	142.4(2)
O(2)-Eu(1)-N(6)	106.4(3)	O(13)-Eu(3)-N(12)	83.1(3)
O(6)-Eu(1)-O(1)#1	83.4(2)	O(13)-Eu(3)-N(8)	80.7(3)
O(6)-Eu(1)-O(3)	142.2(2)	O(11)-Eu(3)-O(10)	77.4(2)
O(6)-Eu(1)-O(7)	72.8(2)	O(11)-Eu(3)-N(12)	65.0(3)
O(6)-Eu(1)-O(2)	144.5(2)	O(11)-Eu(3)-N(8)	107.7(3)
O(6)-Eu(1)-N(4)	81.9(3)	O(12)-Eu(3)-O(10)	116.1(3)
O(6)-Eu(1)-N(6)	81.2(3)	O(12)-Eu(3)-O(11)	142.5(2)
N(4)-Eu(1)-N(6)	81.2(3)	O(12)-Eu(3)-O(9)	81.3(3)
O(8)-Eu(1)-O(1)#1	70.0(2)	O(12)-Eu(3)-N(12)	147.1(3)
O(8)-Eu(1)-O(3)	72.4(2)	O(12)-Eu(3)-N(8)	73.1(3)
O(8)-Eu(1)-O(7)	82.0(2)	O(9)-Eu(3)-O(10)	133.3(2)
O(8)-Eu(1)-O(2)	72.1(2)	O(9)-Eu(3)-O(11)	66.5(2)
O(8)-Eu(1)-O(6)	128.0(3)	O(9)-Eu(3)-N(12)	106.6(3)
O(8)-Eu(1)-N(4)	132.4(3)	O(9)-Eu(3)-N(8)	65.6(3)
O(8)-Eu(1)-N(6)	133.0(3)	N(12)-Eu(3)-N(8)	81.1(3)

Symmetry transformations used to generate equivalent atoms: #1 –x+1, -y+3, -z+1

#2 -x, -y+2, -z

Table S2 Selected bond lengths (Å) and angles (°) for complex 2

Gd(1)-O(1)	2.362(4)	Gd(2)-O(1)	2.376(5)
Gd(1)-O(2)	2.401(4)	Gd(2)-O(2)	2.362(5)
Gd(1)-O(8)	2.358(5)	Gd(2)-O(8)#1	2.306(4)
Gd(1)-O(8)#1	2.422(5)	Gd(2)-O(3)#1	2.423(4)
Gd(1)-O(3)	2.370(4)	Gd(2)-O(5)	2.323(5)
Gd(1)-O(6)	2.297(5)	Gd(2)-O(4)	2.299(5)
Gd(1)-O(7)	2.306(5)	Gd(2)-N(3)	2.567(6)
Gd(1)-N(5)	2.523(6)	Gd(2)-N(1)	2.494(6)
Gd(3)-O(11)#2	2.393(5)	Gd(4)-O(11)	2.367(5)
Gd(3)-O(9)#2	2.430(5)	Gd(4)-O(9)	2.380(5)
Gd(3)-O(14)	2.308(5)	Gd(4)-O(13)	2.295(5)
Gd(3)-O(15)	2.286(5)	Gd(4)-O(12)	2.321(5)
Gd(3)-N(9)	2.525(6)	Gd(4)-O(16)	2.314(5)
Gd(3)-O(16)	2.344(5)	Gd(4)-O(10)	2.392(5)
Gd(3)-O(16)#2	2.401(4)	Gd(4)-N(11)	2.541(6)
Gd(3)-O(10)	2.369(5)	Gd(4)-N(7)	2.549(6)
O(1)-Gd(1)-O(2)	65.69(16)	O(1)-Gd(2)-O(3)#1	77.36(16)
O(1)-Gd(1)-O(8)#1	69.93(16)	O(1)-Gd(2)-N(3)	107.59(19)
O(1)-Gd(1)-O(3)	145.55(16)	O(1)-Gd(2)-N(1)	66.56(18)
O(1)-Gd(1)-N(5)	135.75(17)	O(2)-Gd(2)-O(1)	66.10(16)
O(2)-Gd(1)-O(8)#1	70.00(15)	O(2)-Gd(2)-O(3)#1	133.64(15)
O(2)-Gd(1)-N(5)	78.56(16)	O(2)-Gd(2)-N(3)	66.36(18)
O(8)-Gd(1)-O(1)	76.44(16)	O(2)-Gd(2)-N(1)	108.13(18)
O(8)-Gd(1)-O(2)	132.79(16)	O(8)#1-Gd(2)-O(1)	71.68(17)
O(8)-Gd(1)-O(8)#1	71.25(19)	O(8)#1-Gd(2)-O(2)	72.70(16)
O(8)-Gd(1)-O(3)	69.39(16)	O(8)#1-Gd(2)-O(3)#1	69.32(16)
O(8)#1-Gd(1)-N(5)	73.98(18)	O(8)#1-Gd(2)-O(5)	81.41(17)
O(8)-Gd(1)-N(5)	114.94(17)	O(8)#1-Gd(2)-N(3)	134.26(18)
O(3)-Gd(1)-O(2)	144.99(15)	O(8)#1-Gd(2)-N(1)	132.61(19)
O(3)-Gd(1)-O(8)#1	102.09(16)	O(3)#1-Gd(2)-N(3)	156.42(17)
O(3)-Gd(1)-N(5)	66.59(16)	O(3)#1-Gd(2)-N(1)	80.41(17)
O(6)-Gd(1)-O(1)	84.67(17)	O(5)-Gd(2)-O(1)	142.21(16)
O(6)-Gd(1)-O(2)	119.23(16)	O(5)-Gd(2)-O(2)	81.04(17)
O(6)-Gd(1)-O(8)#1	146.71(17)	O(5)-Gd(2)-O(3)#1	117.57(16)
O(6)-Gd(1)-O(8)	82.35(18)	O(5)-Gd(2)-N(3)	73.10(18)
O(6)-Gd(1)-O(3)	86.60(16)	O(5)-Gd(2)-N(1)	145.93(19)
O(6)-Gd(1)-O(7)	72.37(18)	O(4)-Gd(2)-O(1)	144.14(17)
O(6)-Gd(1)-N(5)	137.44(18)	O(4)-Gd(2)-O(2)	143.33(16)
O(7)-Gd(1)-O(1)	126.21(18)	O(4)-Gd(2)-O(8)#1	127.27(18)
O(7)-Gd(1)-O(2)	84.09(17)	O(4)-Gd(2)-O(3)#1	82.30(16)

O(7)-Gd(1)-O(8)	142.74(18)	O(4)-Gd(2)-O(5)	73.60(18)
O(7)-Gd(1)-O(8)#1	140.26(18)	O(4)-Gd(2)-N(3)	80.99(19)
O(7)-Gd(1)-O(3)	81.97(18)	O(4)-Gd(2)-N(1)	81.2(2)
O(7)-Gd(1)-N(5)	71.65(19)	N(1)-Gd(2)-N(3)	80.69(19)
O(11)#2-Gd(3)-O(9)#2	65.43(16)	O(11)-Gd(4)-O(9)	66.61(16)
O(11)#2-Gd(3)-N(9)	136.13(17)	O(11)-Gd(4)-O(10)	77.45(17)
O(11)#2-Gd(3)-O(16)#2	70.11(16)	O(11)-Gd(4)-N(11)	66.09(18)
O(9)#2-Gd(3)-N(9)	78.96(18)	O(11)-Gd(4)-N(7)	108.90(18)
O(14)-Gd(3)-O(11)#2	81.82(16)	O(9)-Gd(4)-O(10)	134.02(16)
O(14)-Gd(3)-O(9)#2	117.09(18)	O(9)-Gd(4)-N(11)	106.72(19)
O(14)-Gd(3)-N(9)	139.54(17)	O(9)-Gd(4)-N(7)	66.11(18)
O(14)-Gd(3)-O(16)#2	145.05(16)	O(13)-Gd(4)-O(11)	144.22(17)
O(14)-Gd(3)-O(16)	81.55(17)	O(13)-Gd(4)-O(9)	143.23(17)
O(14)-Gd(3)-O(10)	88.67(17)	O(13)-Gd(4)-O(12)	73.75(17)
O(15)-Gd(3)-O(11)#2	125.07(18)	O(13)-Gd(4)-O(16)	126.83(17)
O(15)-Gd(3)-O(9)#2	84.64(17)	O(13)-Gd(4)-O(10)	81.84(17)
O(15)-Gd(3)-O(14)	72.17(17)	O(13)-Gd(4)-N(11)	82.53(18)
O(15)-Gd(3)-N(9)	72.93(18)	O(13)-Gd(4)-N(7)	81.02(19)
O(15)-Gd(3)-O(16)	141.43(16)	O(12)-Gd(4)-O(11)	141.84(17)
O(15)-Gd(3)-O(16)#2	141.54(16)	O(12)-Gd(4)-O(9)	81.10(17)
O(15)-Gd(3)-O(10)	81.53(18)	O(12)-Gd(4)-O(10)	115.84(17)
O(16)-Gd(3)-O(11)#2	76.61(17)	O(12)-Gd(4)-N(11)	146.97(19)
O(16)#2-Gd(3)-O(9)#2	69.87(16)	O(12)-Gd(4)-N(7)	73.25(18)
O(16)-Gd(3)-O(9)#2	133.19(15)	O(16)-Gd(4)-O(11)	72.05(16)
O(16)#2-Gd(3)-N(9)	74.23(17)	O(16)-Gd(4)-O(9)	72.21(16)
O(16)-Gd(3)-N(9)	115.59(18)	O(16)-Gd(4)-O(12)	79.30(17)
O(16)-Gd(3)-O(16)#2	72.21(17)	O(16)-Gd(4)-O(10)	70.02(16)
O(16)-Gd(3)-O(10)	69.92(16)	O(16)-Gd(4)-N(11)	133.73(18)
O(10)-Gd(3)-O(11)#2	146.20(16)	O(16)-Gd(4)-N(7)	132.70(18)
O(10)-Gd(3)-O(9)#2	145.19(16)	O(10)-Gd(4)-N(11)	82.26(19)
O(10)-Gd(3)-N(9)	66.48(18)	O(10)-Gd(4)-N(7)	157.20(18)
O(10)-Gd(3)-O(16)#2	103.04(17)	N(11)-Gd(4)-N(7)	80.7(2)

Symmetry transformations used to generate equivalent atoms: #1 -x, -y, -z #2 -x+1, -y+1, -z+1

Table S3 Selected bond lengths (Å) and angles (°) for complex 3

Dy(3)-O(13)	2.296(4)	Dy(1)-O(3)	2.385(4)
Dy(3)-O(12)	2.340(5)	Dy(1)-O(2)	2.413(4)
Dy(3)-O(10)	2.389(4)	Dy(1)-O(6)	2.324(5)
Dy(3)-O(9)#1	2.386(5)	Dy(1)-O(1)	2.365(4)
Dy(3)-O(11)	2.406(4)	Dy(1)-O(7)	2.324(5)
Dy(3)-N(10)	2.569(6)	Dy(1)-O(8)	2.439(4)
Dy(3)-O(16)	2.315(4)	Dy(1)-O(8)#2	2.364(4)
Dy(3)-N(8)#1	2.549(5)	Dy(1)-N(6)	2.528(6)

Dy(4)-O(10)#1	2.433(4)	Dy(2)-O(3)#2	2.438(4)
Dy(4)-O(9)	2.400(4)	Dy(2)-O(2)	2.384(4)
Dy(4)-O(11)	2.384(4)	Dy(2)-O(1)	2.391(4)
Dy(4)-O(14)	2.323(5)	Dy(2)-O(5)	2.318(4)
Dy(4)-O(16)#1	2.433(5)	Dy(2)-O(4)	2.338(5)
Dy(4)-O(16)	2.353(4)	Dy(2)-O(8)	2.318(4)
Dy(4)-N(12)	2.546(5)	Dy(2)-N(4)	2.565(6)
Dy(4)-O(15)	2.304(4)	Dy(2)-N(2)	2.525(6)
O(13)-Dy(3)-O(12)	73.37(15)	O(3)-Dy(1)-O(2)	144.39(15)
O(13)-Dy(3)-O(10)	142.98(15)	O(3)-Dy(1)-O(8)	102.14(15)
O(13)-Dy(3)-O(9)#1	144.51(15)	O(3)-Dy(1)-N(6)	66.23(16)
O(13)-Dy(3)-O(11)	82.49(15)	O(2)-Dy(1)-O(8)	70.05(14)
O(13)-Dy(3)-N(10)	80.85(17)	O(2)-Dy(1)-N(6)	78.34(16)
O(13)-Dy(3)-O(16)	126.91(16)	O(6)-Dy(1)-O(3)	86.29(16)
O(13)-Dy(3)-N(8)#1	83.19(17)	O(6)-Dy(1)-O(2)	119.52(16)
O(12)-Dy(3)-O(10)	81.45(16)	O(6)-Dy(1)-O(1)	85.23(16)
O(12)-Dy(3)-O(9)#1	141.95(15)	O(6)-Dy(1)-O(8)	147.41(16)
O(12)-Dy(3)-O(11)	116.40(16)	O(6)-Dy(1)-O(8)#2	82.55(16)
O(12)-Dy(3)-N(10)	73.39(17)	O(6)-Dy(1)-N(6)	136.55(17)
O(12)-Dy(3)-N(8)#1	147.29(17)	O(1)-Dy(1)-O(3)	145.89(15)
O(10)-Dy(3)-O(11)	133.76(14)	O(1)-Dy(1)-O(2)	66.05(15)
O(10)-Dy(3)-N(10)	66.00(16)	O(1)-Dy(1)-O(8)	70.09(16)
O(10)-Dy(3)-N(8)#1	106.08(17)	O(1)-Dy(1)-N(6)	136.00(16)
O(9)#1-Dy(3)-O(10)	66.34(15)	O(7)-Dy(1)-O(3)	82.29(17)
O(9)#1-Dy(3)-O(11)	77.06(15)	O(7)-Dy(1)-O(2)	84.03(16)
O(9)#1-Dy(3)-N(10)	108.58(17)	O(7)-Dy(1)-O(6)	70.59(17)
O(9)#1-Dy(3)-N(8)#1	65.53(16)	O(7)-Dy(1)-O(1)	125.15(18)
O(11)-Dy(3)-N(10)	157.09(15)	O(7)-Dy(1)-O(8)#2	142.25(16)
O(11)-Dy(3)-N(8)#1	81.79(17)	O(7)-Dy(1)-O(8)	141.29(16)
O(16)-Dy(3)-O(12)	79.51(16)	O(7)-Dy(1)-N(6)	72.80(18)
O(16)-Dy(3)-O(10)	72.43(15)	O(8)#2-Dy(1)-O(3)	69.65(15)
O(16)-Dy(3)-O(9)#1	72.07(15)	O(8)#2-Dy(1)-O(2)	133.17(15)
O(16)-Dy(3)-O(11)	70.04(14)	O(8)#2-Dy(1)-O(1)	76.51(15)
O(16)-Dy(3)-N(10)	132.84(16)	O(8)#2-Dy(1)-O(8)	71.47(17)
O(16)-Dy(3)-N(8)#1	133.20(17)	O(8)#2-Dy(1)-N(6)	115.11(17)
N(8)#1-Dy(3)-N(10)	80.72(18)	O(8)-Dy(1)-N(6)	74.12(16)
O(10)#1-Dy(4)-N(12)	78.88(16)	O(3)#2-Dy(2)-N(4)	156.71(17)
O(9)-Dy(4)-O(10)#1	65.43(15)	O(3)#2-Dy(2)-N(2)	80.06(17)
O(9)-Dy(4)-O(16)#1	69.83(15)	O(2)-Dy(2)-O(3)#2	133.75(14)
O(9)-Dy(4)-N(12)	135.99(16)	O(2)-Dy(2)-O(1)	66.11(14)
O(11)-Dy(4)-O(10)#1	144.96(14)	O(2)-Dy(2)-N(4)	66.00(16)
O(11)-Dy(4)-O(9)	146.07(15)	O(2)-Dy(2)-N(2)	108.16(17)
O(11)-Dy(4)-O(16)#1	102.72(15)	O(1)-Dy(2)-O(3)#2	77.47(15)

O(11)-Dy(4)-N(12)	66.27(16)	O(1)-Dy(2)-N(4)	107.42(17)
O(14)-Dy(4)-O(10)#1	117.92(16)	O(1)-Dy(2)-N(2)	66.18(17)
O(14)-Dy(4)-O(9)	82.61(15)	O(5)-Dy(2)-O(3)#2	83.16(15)
O(14)-Dy(4)-O(11)	88.28(16)	O(5)-Dy(2)-O(2)	142.38(15)
O(14)-Dy(4)-O(16)#1	145.24(15)	O(5)-Dy(2)-O(1)	144.59(16)
O(14)-Dy(4)-O(16)	81.21(16)	O(5)-Dy(2)-O(4)	73.66(16)
O(14)-Dy(4)-N(12)	139.07(16)	O(5)-Dy(2)-O(8)	127.90(16)
O(16)#1-Dy(4)-O(10)#1	69.68(15)	O(5)-Dy(2)-N(4)	80.35(17)
O(16)-Dy(4)-O(10)#1	133.14(14)	O(5)-Dy(2)-N(2)	81.55(18)
O(16)-Dy(4)-O(9)	76.52(15)	O(4)-Dy(2)-O(3)#2	117.68(16)
O(16)-Dy(4)-O(11)	69.79(14)	O(4)-Dy(2)-O(2)	80.58(16)
O(16)-Dy(4)-O(16)#1	72.27(18)	O(4)-Dy(2)-O(1)	141.73(16)
O(16)#1-Dy(4)-N(12)	74.29(16)	O(4)-Dy(2)-N(4)	73.02(18)
O(16)-Dy(4)-N(12)	115.63(17)	O(4)-Dy(2)-N(2)	146.73(18)
O(15)-Dy(4)-O(9)	126.23(17)	O(8)-Dy(2)-O(3)#2	69.48(15)
O(15)-Dy(4)-O(11)	80.82(16)	O(8)-Dy(2)-O(2)	72.61(15)
O(15)-Dy(4)-O(14)	72.27(16)	O(8)-Dy(2)-O(1)	71.74(16)
O(15)-Dy(4)-O(16)	140.77(16)	O(8)-Dy(2)-O(4)	81.01(16)
O(15)-Dy(4)-O(16)#1	141.56(16)	O(8)-Dy(2)-N(4)	133.81(17)
O(15)-Dy(4)-N(12)	72.39(17)	O(8)-Dy(2)-N(2)	132.22(17)
		N(2)-Dy(2)-N(4)	81.34(19)

Symmetry transformations used to generate equivalent atoms: #1 -x-1,-y+1,-z+1 #2 -x,-y,-z

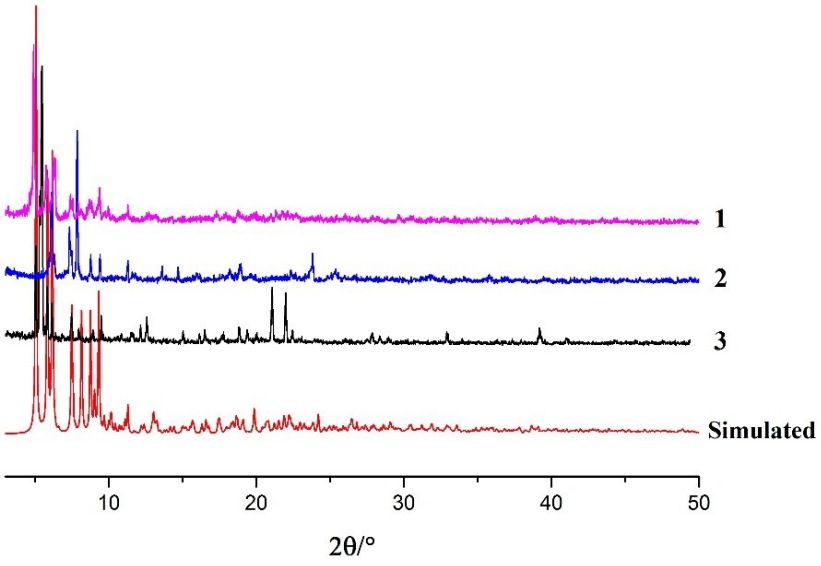


Fig. S1 Simulated and experimental PXRD patterns of complexes **1**-**3**.

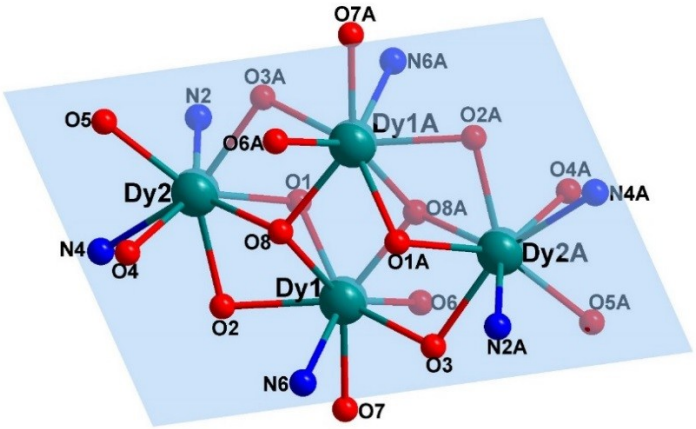


Fig. S2 The structure of [Dy_4] cluster in complex **3**.

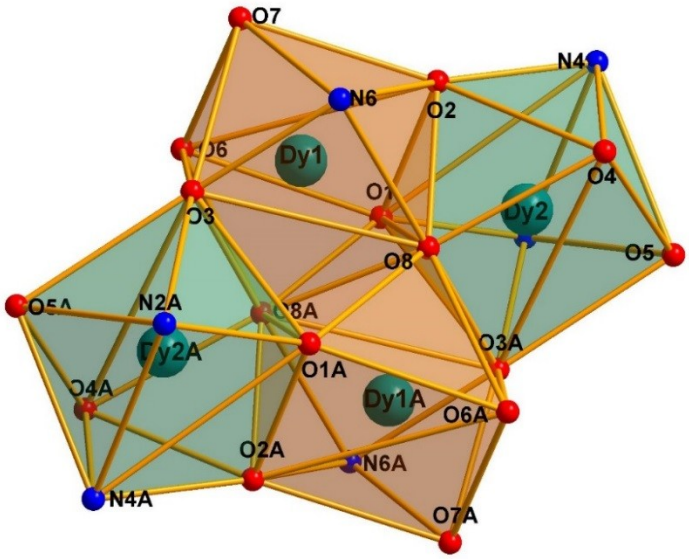


Fig. S3 The coordination polyhedron observed in complex **3**.

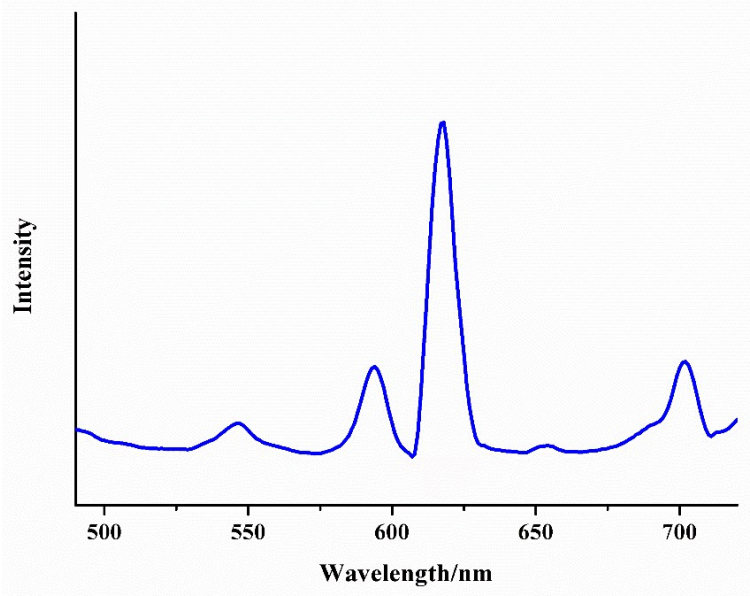


Fig. S4 The emission spectra of complex **1**.

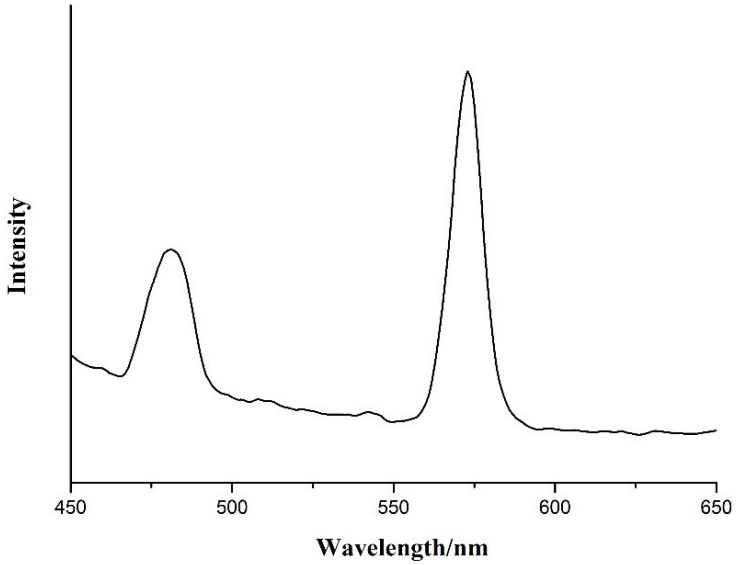


Fig. S5 The emission spectra of complex **3**.

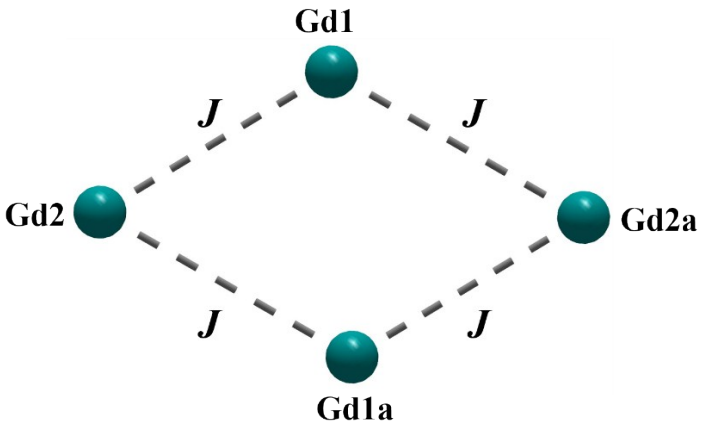
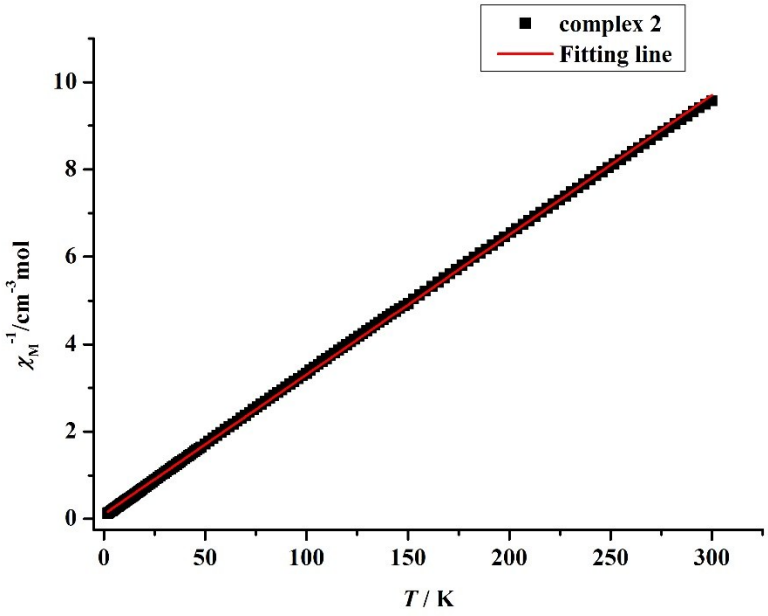


Fig. S6 The model used to fit the $\chi_M T$~T plots for complex **2**.



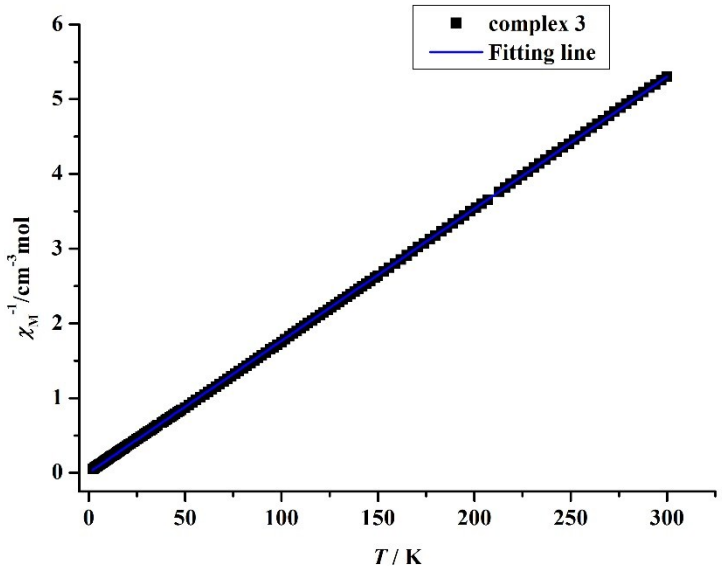


Fig. S7 The χ_M^{-1} versus T and the Curie-Weiss linear fit for complexes **2** and **3**.

Table S4 The energy barriers for some butterfly-shaped Dy_4 complexes

The formula of butterfly-shaped Dy_4 complexes	Energy barrier/K
$[Dy_4(\mu_3\text{-}OH)_2(L3)_6(tmhd)_4]\cdot CH3CN$	46.4
$[Dy_4(\mu_3\text{-}OH)_2(L4)_6(acac)_4]$	79.15
$[Dy_4(\mu_3\text{-}OH)_2(ampdH_4)_2(piv)_{10}]$	5.4
Compound **3** in this work	35.8
$[Dy_4(\mu_3\text{-}OH)_2(ovn)(piv)_4(NO_3)_2]$	5.1
$[Dy_4(\mu_3\text{-}OH)_2(mdeaH)_2(piv)_8$	6.2
$[Dy_4(L5)_4(OH)_2(DMF)_2(tfaa)_2]\cdot 2CH_3CN$	39