Supporting Information

Magnetic Properties and Structure of Tetranuclear Lanthanide Complexes Based on 8-hydroxylquinoline Schiff Base Derivative and *β*-diketone coligand

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Table S1. The important bond lengths [Å] and angles [°] for **1**

Bond distances			
Gd1-Gd2	3.6056 (6)	Gd1a-Gd2	3.8970(8)
Gd1-Gd2a	3.8970(8)	Gd2-Gd2a	3.8722(9)
Gd1-O4	2.337(5)	Gd1-O5	2.353(5)
Gd2a-O8	2.357(5)	Gd1-O1	2.408(5)
Gd1-O8	2.346(5)	Gd1-O3	2.403(5)
Gd2-O8	2.412(5)	Gd1-O2	2.407(5)
Gd2-N1a	2.581(6)	Gd2-O7	2.339(5)
Gd2-O8a	2.357(5)	Gd2-O6	2.326(5)
Gd2-O3	2.402(5)	Gd2-O2	2.437(5)
Gd2-O1a	2.388(5)	Gd1-N5	2.560(6)
Gd1-N3	2.549(6)	Gd2a-O1	2.388(5)
Gd2a-N1	2.581(6)		
Angles			
Gd1-Gd2-Gd2a	62.699(14)	Gd2-Gd1-Gd2a	62.000(14)
Gd1-Gd2-Gd1a	117.998(14)	Gd1a-Gd2-Gd2a	55.299(11)
Gd1-O1-Gd2a	108.68(18)	Gd1-O2-Gd2	95.95(17)
Gd1-O3-Gd2	97.24(16)	Gd1-O8-Gd2a	111.92(19)
Gd2-O8-Gd2a	108.56(18)	Gd1-O8-Gd2	98.54(18)

Table S2. The important bond lengths [Å] and angles [°] for **2**

Bond distances			
Tb1-Tb2	3.5897(3)	Tb1a- Tb2	3.8852(3)
Tb1- Tb2a	3.8852(3)	Tb2- Tb2a	3.8489(4)
Tb1-O4	2.319(3)	Tb1-O5	2.337(3)
Tb2-O8	2.392(3)	Tb1-O1	2.407(3)
Tb1-O8	2.339(3)	Tb1-O3	2.388(3)
Tb2a-O8	2.346(3)	Tb1-O2	2.386(3)
Tb2-N1a	2.553(3)	Tb2-O7	2.318(3)
Tb2-O8a	2.346(3)	Tb2-O6	2.335(3)
Tb2-O3	2.427(3)	Tb2-O2	2.392(3)
Tb2-O1a	2.385(3)	Tb1-N7	2.565(4)
Tb1-N4	2.557(4)	Tb2a-O1	2.385(3)
Tb2a-N1	2.553(3)		
Angles			
Tb1-Tb2-Tb1a	118.167(6)	Tb2-Tb1-Tb2a	61.832(6)
Tb1-Tb2-Tb2a	62.861(6)	Tb1a-Tb2-Tb2a	55.306(6)
Tb1-O1-Tb2a	108.34(10)	Tb1-O2-Tb2	97.4(1)
Tb1-O3-Tb2	96.4(1)	Tb1-O8-Tb2a	112.04(11)
Tb2-O8-Tb2a	108.64(10)	Tb1-O8-Tb2	98.71(11)

Table S3. The important bond lengths [Å] and angles [°] for **3**

Bond distances			
Dy1-Dy2	3.5621 (3)	Dy1-Dy1a	3.8194(5)
Dy1-Dy2a	3.8628(4)	Dy1a-Dy2	3.8628(4)
Dy1-O4	2.303(3)	Dy1-O5	2.320(3)
Dy1-O8a	2.332(3)	Dy1-O1	2.366(3)
Dy1-O8	2.367(3)	Dy1-O3	2.379(3)
Dy1a-O8	2.332(3)	Dy1-O2	2.417(3)
Dy1-N1	2.540(4)	Dy2-O7	2.305(3)
Dy2-O8	2.335(3)	Dy2-O6	2.320(3)
Dy2-O3	2.363(3)	Dy2-O2	2.376(3)
Dy2-O1a	2.393(3)	Dy2-N7	2.537(4)
Dy2-N4	2.551(4)	Dy2a-O1	2.393(3)
Angles			
Dy1-Dy2-Dy1a	61.758(7)	Dy2-Dy1-Dy2a	118.243(7)
Dy1a-Dy1-Dy2a	55.247(6)	Dy2-Dy1-Dy1a	62.996(7)
Dy1-O1-Dy2a	108.52(11)	Dy1-O2-Dy2	96.02(11)
Dy1-O3-Dy2	97.38(10)	Dy1a-O8-Dy2	111.73(11)
Dy1-O8-Dy1a	108.73(11)	Dy1-O8-Dy2	98.51(11)

Table S4. The important bond lengths [Å] and angles [°] for **4**

Bond distances			
Ho1-Ho2	3.5508(4)	Ho1-Ho1a	3.8062(5)
Ho1-Ho2a	3.8503(5)	Ho1a-Ho2	3.8504(5)
Ho1-O4	2.302(3)	Ho1-O5	2.313(4)
Ho1-O8a	2.320(3)	Ho1-O1	2.367(3)
Ho1-O8	2.370(3)	Ho1-O3	2.372(3)
Ho1a-O8	2.320(3)	Ho1-O2	2.403(3)
Ho1-N1	2.532(4)	Ho2-O7	2.303(3)
Ho2-O8	2.323(3)	Ho2-O6	2.316(4)
Ho2-O3	2.361(3)	Ho2-O2	2.365(3)
Ho2-O1a	2.382(4)	Ho2-N7	2.529(4)
Ho2-N4	2.541(4)	Ho2a-O1	2.382(4)
Angles			
Ho1-Ho2-Ho1a	61.740(9)	Ho2-Ho1-Ho2a	118.260(9)
Ho1a-Ho1-Ho2	63.003(9)	Ho1a- Ho1-Ho2a	55.257(7)
Ho1-O1-Ho2a	108.32(13)	Ho1-O2-Ho2	96.24(12)
Ho1-O3-Ho2	97.21(12)	Ho1a-O8- Ho2	112.06(13)
Ho1-O8- Ho1a	108.49(13)	Ho1-O8- Ho2	98.32 (13)

Table S5. The important bond lengths [Å] and angles [°] for **5**

Bond distances			
Er1-Er2	3.5355(3)	Er1a-Er2	3.8354(3)
Er1-Er2a	3.8355(3)	Er2-Er2a	3.7900(4)
Er1-O4	2.298(3)	Er1-O5	2.308(3)
Er2-O8a	2.360(2)	Er1-O1	2.368(3)
Er1a-O8	2.306(3)	Er1-O3	2.356(3)
Er1-O8a	2.306(3)	Er1-O2	2.355(3)
Er2-N1a	2.520(3)	Er2-O7	2.308(3)
Er2-O8	2.313(2)	Er2-O6	2.292(2)
Er2-O3	2.399(2)	Er2-O2	2.3633)
Er2-O1a	2.354(3)	Er1-N7	2.534(3)
Er1-N4	2.517(3)	Er2a-O1	2.354(3)
Er2a-O8	2.369(2)		
Angles			
Er1-Er2-Er1a	118.27(1)	Er2-Er1-Er2a	61.73(1)
Er1a-Er2-Er2a	55.240	Er1-Er2-Er2a	63.03(1)
Er1-O1-Er2a	108.62(10)	Er1-O2-Er2	97.07(9)
Er1-O3-Er2	96.08(8)	Er1a-O8-Er2	112.27(10)
Er2-O8-Er2a	108.41(9)	Er1a-O8-Er2a	98.53(9)

Table S6. Comparison of some important bond lengths and bond angles

Aromatic aldehyde and *β*-diketonate	Dy-O (Å)	Dy-N (Å)	Dy···Dy (shortest) (Å)	*α* angle (°)	O-Dy-O (°)	Ref.
4-pyridinecarboxaldehyde $Dy(dbm)_3·2H_2O$	**2.303(3)-2.417(3)**	**2.537(4)-2.551(4)**	**3.5621(3)**	**51.41-65.09**	**67.71(10)-145.13(10)**	**this work**
4-fluorobenzaldehyde $Dy(dbm)_3·2H_2O$	2.287(3)-2.391(4)	2.497(4)-2.521(5)	3.5233(6)	52.7-64.9	67.81(12)-143.99(13)	16(a)
4-fluorobenzaldehyde $Dy(acac)_3·2H_2O$	2.299(3)-2.443(4)	2.509(5)-2.551(5)	3.5659(6)	52.12-57.52	67.81(12)-143.99(13)	16(b)
Benzaldehyde $Dy(acac)_3·2H_2O$	2.279(4)-2.413(4)	2.516(5)-2.552(5)	3.5391(9)	52.7-64.9	67.25(14)-146.55(14)	16(c)

Table S7. The Dy^{III} geometry analysis by SHAPE 2.0 for complex **3**.

	Square antiprism (D_{4d})	**Triangular dodecahedrom (D_{2d})**	**Biaugmented trigonal prism J50 (C_{2v})**	**Biaugmented trigonal prism (C_{2v})**	**Snub diphenoid J84 (D_{2d})**
Dy1	0.950	2.385	2.271	1.677	4.502
Dy2	1.462	2.064	2.812	2.018	4.966

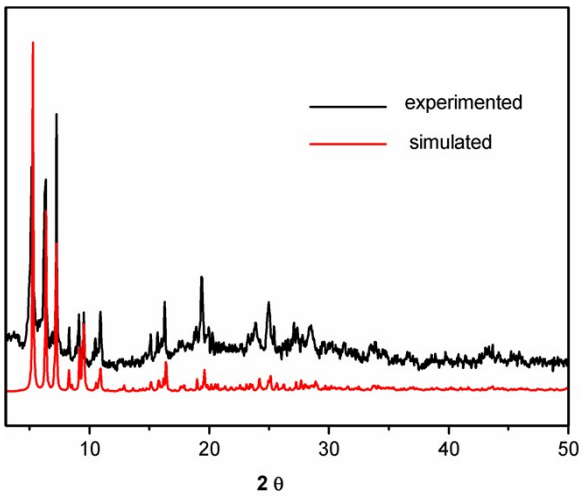

Fig. S1 PXRD pattern of complex **1**.

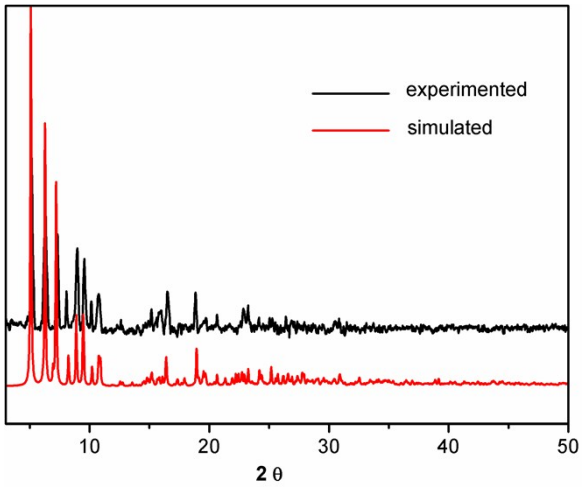

Fig. S2 PXRD pattern of complex **2**.

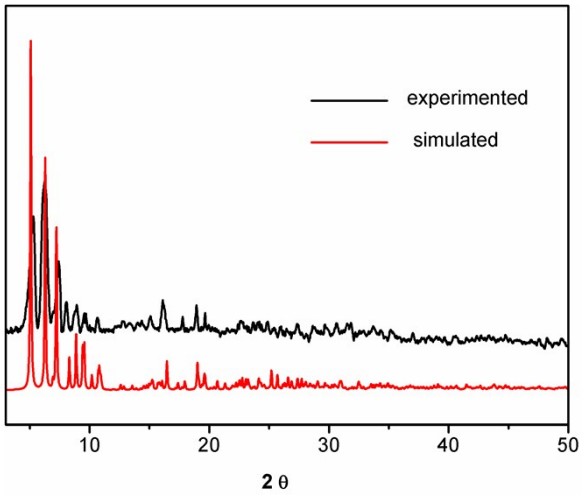

Fig. S3 PXRD pattern of complex **3**.

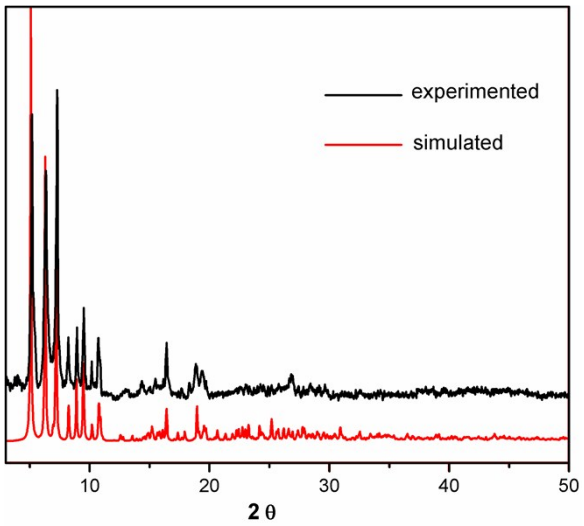

Fig. S4 PXRD pattern of complex **4**.

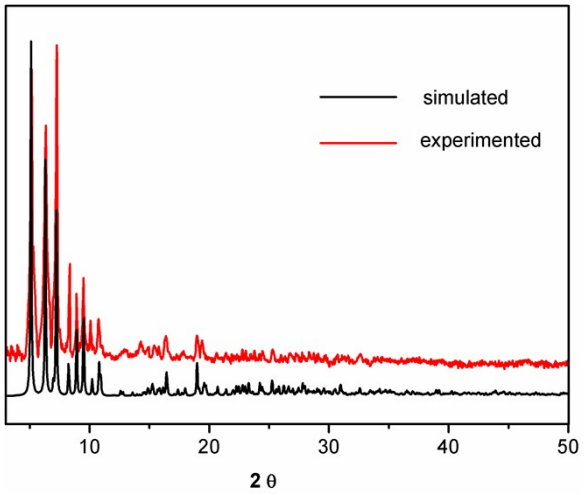

Fig. S5 PXRD pattern of complex **5**.

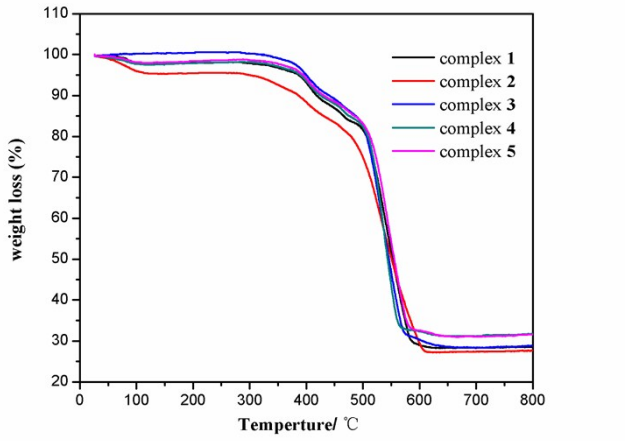

Fig. S6 TGA spectra of complexes **1-5**.

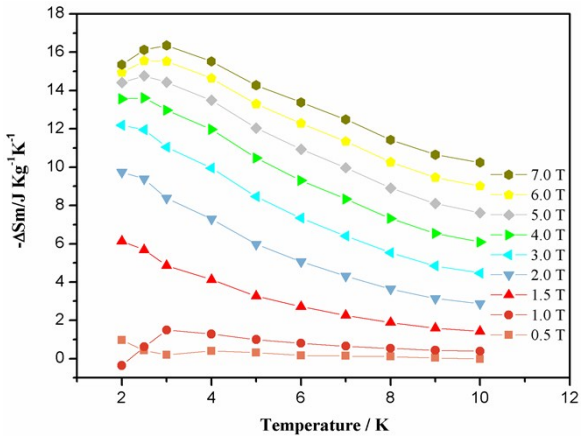

Fig. S7 Temperature dependencies of magnetic entropy change ($-\Delta S_m$) as calculated from the magnetization data of **1** at T = 2-10 K and 0-7 T.

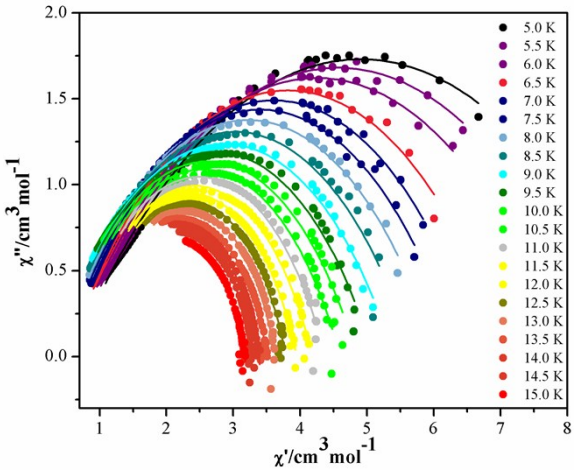

Fig. S8 Cole–Cole plots measured at 2–14 K for **3** (H_{dc} = 0 Oe), the solid lines are the best fits to the experimental data, obtained with the generalized Debye model with α= 0.21−0.51.