Supporting Information

Anion Effects on the Structures and Magnetic Properties of Binuclear Lanthanide Single-Molecule Magnets

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Table S1. Selected bond lengths (Å) for compounds **1-4**.

Compound 1		**Compound 3**	
Dy1-O1	2.187(5)	Gd1-O1	2.232(2)
Dy1-O2	2.329(4)	Gd1-O2	2.377(8)
Dy1-O2#1	2.385(3)	Gd1-O2#1	2.395(2)
Dy1-O6	2.420(4)	Gd1-O6	2.457(2)
Dy1-O10	2.430(5)	Gd1-O10	2.460(2)
Dy1-O3	2.481(5)	Gd1-O3	2.508
Dy1-O9	2.510(5)	Gd1-O4	2.534
Dy1-O7	2.516(5)	Gd1-O9	2.536
Dy1-O4	2.526(5)	Gd1-O7	2.538
Dy1…Dy1#1	3.914(5)	Gd1…Gd1#1	3.969(7)
Dy1-O2-Dy1#1	112.26(1)	Gd1-O1-Gd1#1	112.55(8)

Compound 2		**Compound 4**	
Dy1-O1	2.135(3)	Gd1-O1	2.160(2)
Dy1-O2#1	2.300(3)	Gd1-O2#1	2.328(2)
Dy1-O2	2.361(3)	Gd1-O2	2.378(2)
Dy1-Cl2	2.609(8)	Gd1-Cl2	2.644(1)
Dy1-Cl1	2.642(4)	Gd1-Cl1	2.655(0)
Dy1-Cl3	2.674(3)	Gd1-Cl3	2.699(9)
Dy1…Dy1#1	3.836(8)	Gd1…Gd1#1	3.883 (6)
Dy1-O2-Dy1#1	110.81(1)	Gd1-O2-Gd1#1	111.21(8)

[a] Symmetry transformations used to generate equivalent atoms: for **1** and **3**: #1 -x-1/2,y+1/2,-z+1/2; for **2** and **4**: #1 -x,-y,-z.

Table S2. Relaxation fitting parameters from least-squares fitting of the data for compound **1** to a distribution of single relaxation processes with a generalized Debye model.[a]

T (K)	τ (s)	χ_S (emu mol^{-1})	χ_T (emu mol^{-1})	α
5.0	0.00542	0.123	3.58	0.0479
5.5	0.00376	0.122	3.27	0.0268
6.0	0.00265	0.127	3.01	0.0102
6.5	0.00191	0.126	2.79	7.80E-4
7.0	0.00140	0.122	2.68	0
7.5	0.00106	0.134	2.47	0
8.0	7.93E-4	0.146	2.33	0
8.5	6.27E-4	0.160	2.21	0
9.0	4.98E-4	0.190	2.10	0

[a] Refs. K. S. Cole and R. H. Cole, *J. Chem. Phys*., 1941, **9**, 341; S. M. Aubin, Z. Sun, L. Pardi, J. Krzystek, K. Folting, L. C. Brunel, A. L. Rheingold, G. Christou and D. N. Hendrickson, *Inorg. Chem*., 1999, **38**, 5329.

Table S3. Relaxation fitting parameters from least-squares fitting of the data for compound **2** to a distribution of single relaxation processes with a generalized Debye model.

T (K)	τ (s)	χ_S (emu mol^{-1})	χ_T (emu mol^{-1})	α
12.0	0.00421	0.141	1.85	0.0622
13.0	0.00293	0.163	1.71	0.0360
14.0	0.00212	0.171	1.60	0.0332
15.0	0.00162	0.194	1.50	0.0120
16.0	0.00125	0.222	1.41	0.00879
17.0	9.59E-4	0.215	1.34	0.00298
18.0	7.92E-4	0.248	1.27	0
19.0	6.51E-4	0.270	1.21	0
20.0	5.37E-4	0.289	1.16	0
21.0	4.47E-4	0.322	1.11	0
22.0	3.73E-4	0.356	1.06	0

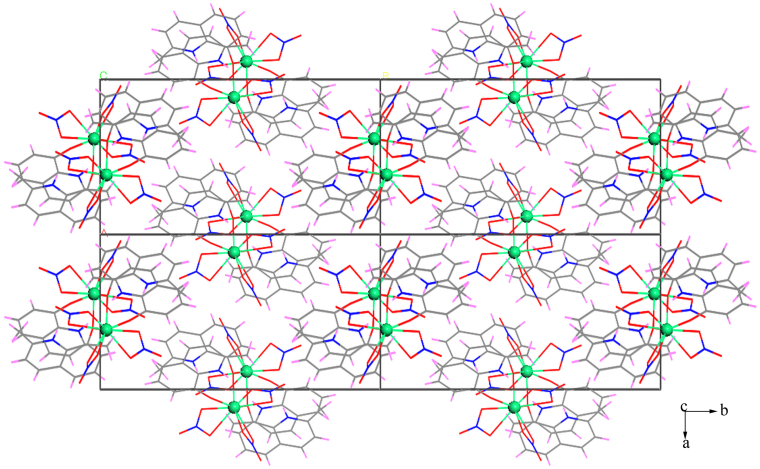

Fig. S1. Packing arrangement of **1** along the crystallographic *c* axis.

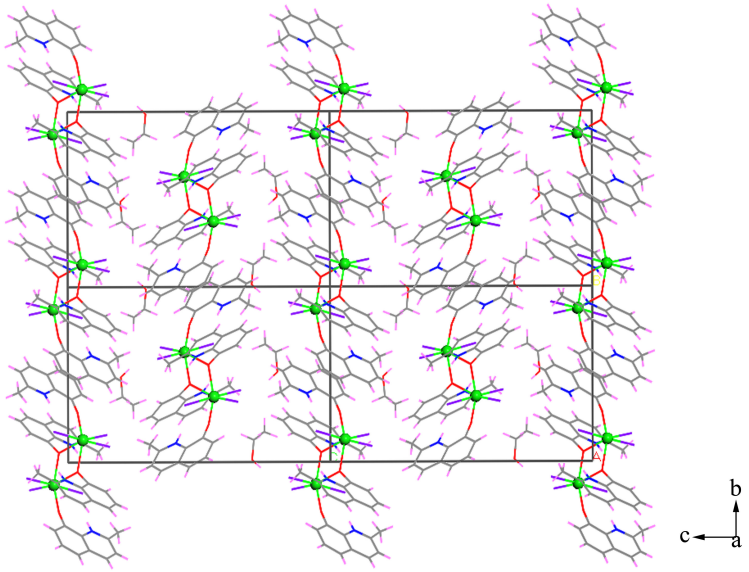

Fig. S2. Packing arrangement of **2** along the crystallographic *a* axis.

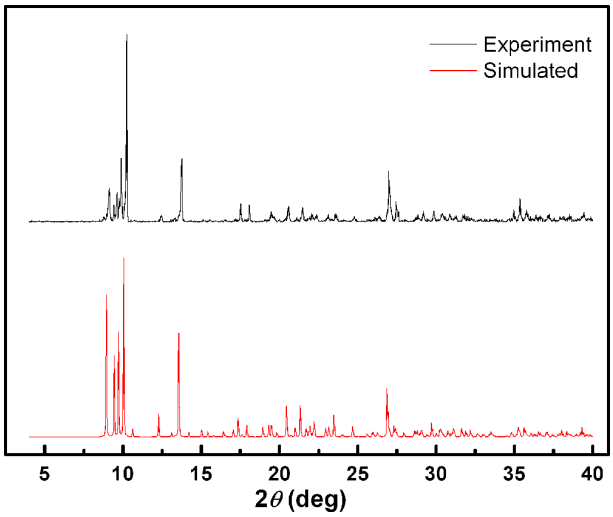

Fig. S3. XRPD pattern for compound **1.**

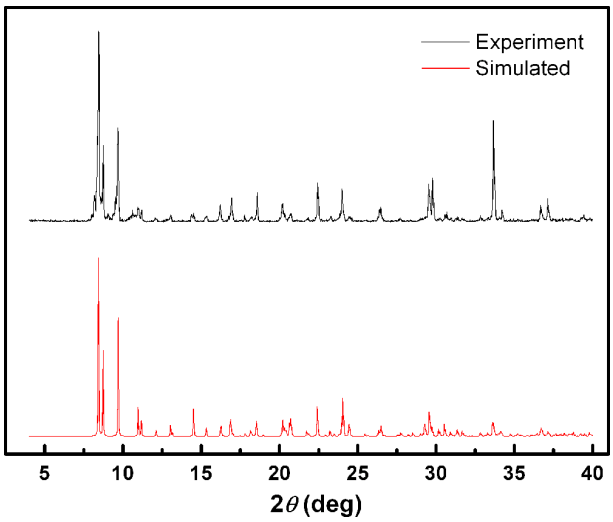

Fig. S4. XRPD pattern for compound **2.**

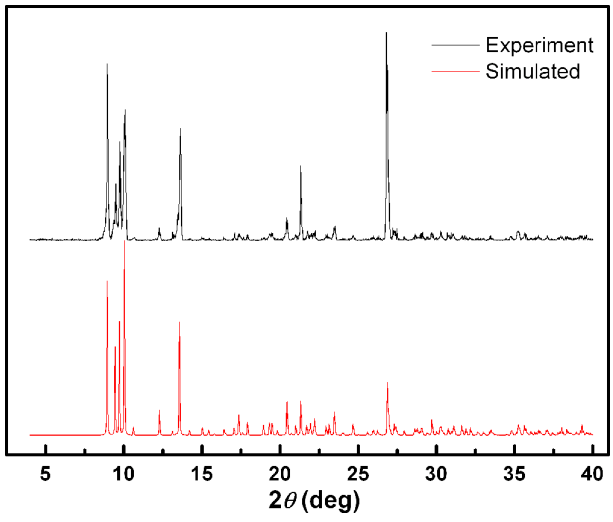

Fig. S5. XRPD pattern for compound **3.**

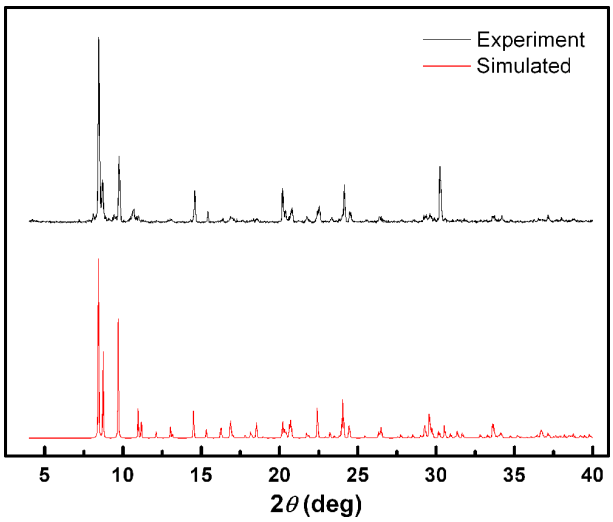

Fig. S6. XRPD pattern for compound **4.**

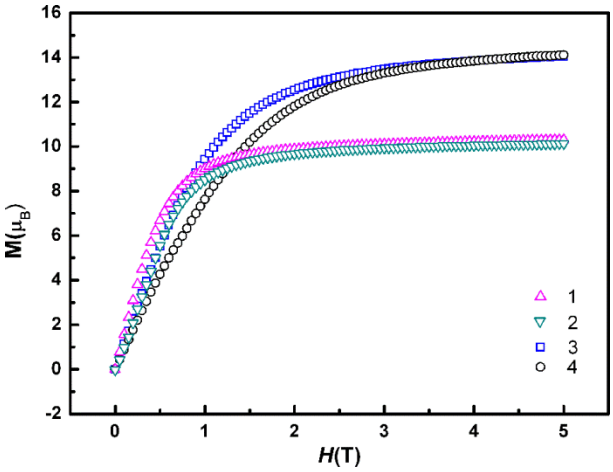

Fig. S7. Field dependence of the magnetization for compounds **1-4** at 2K.

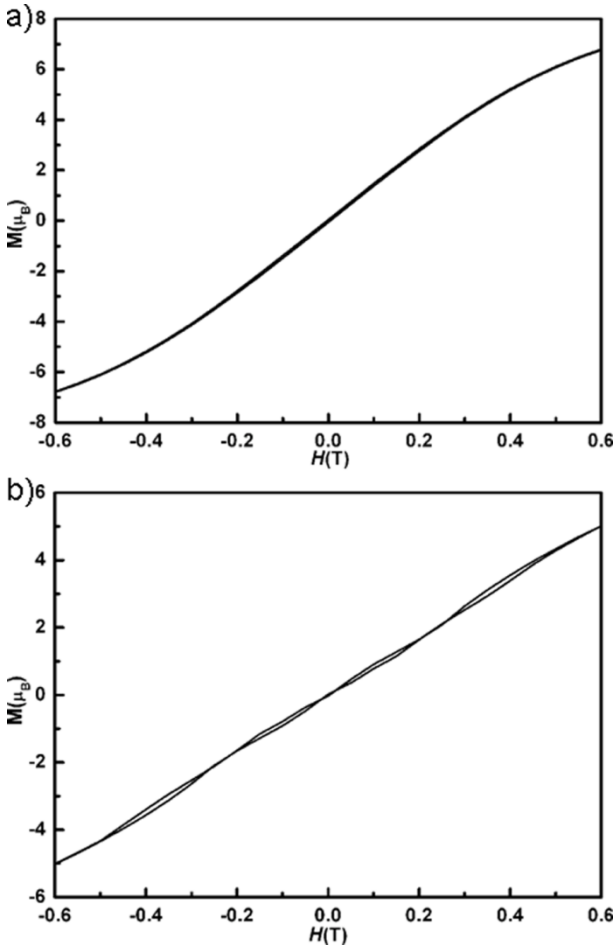

Fig. S8. Hysteresis loops for compounds **1**(a) and **2**(b) at 2 K.