Supporting Information

Anion-Controlled Assembly of a Series of Heterometallic 3d–4f Compounds with 0D Cluster, 1D Chain, 2D Network and 3D Frameworks

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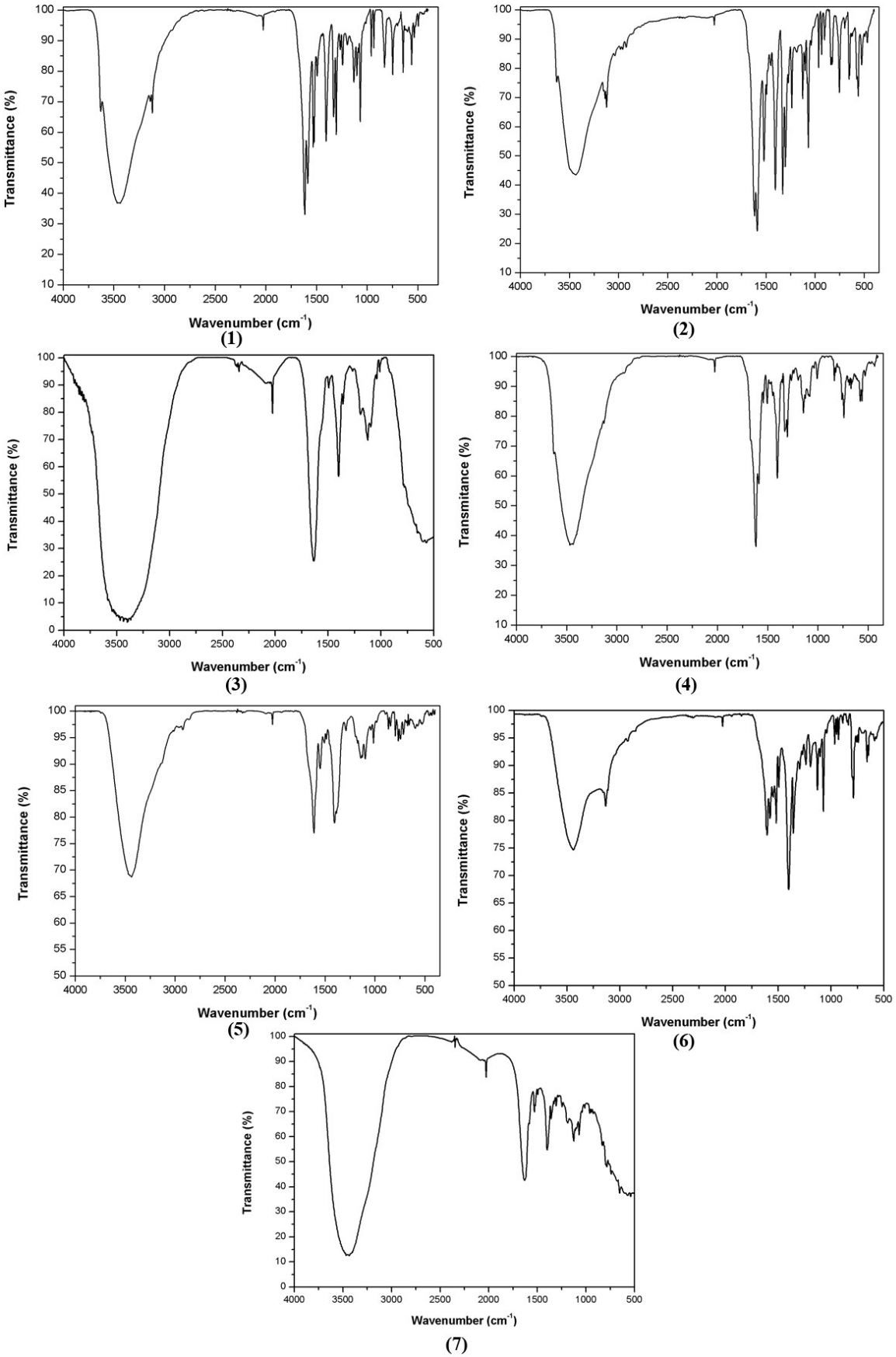

Fig. S1 IR spectrum of **1-7.**

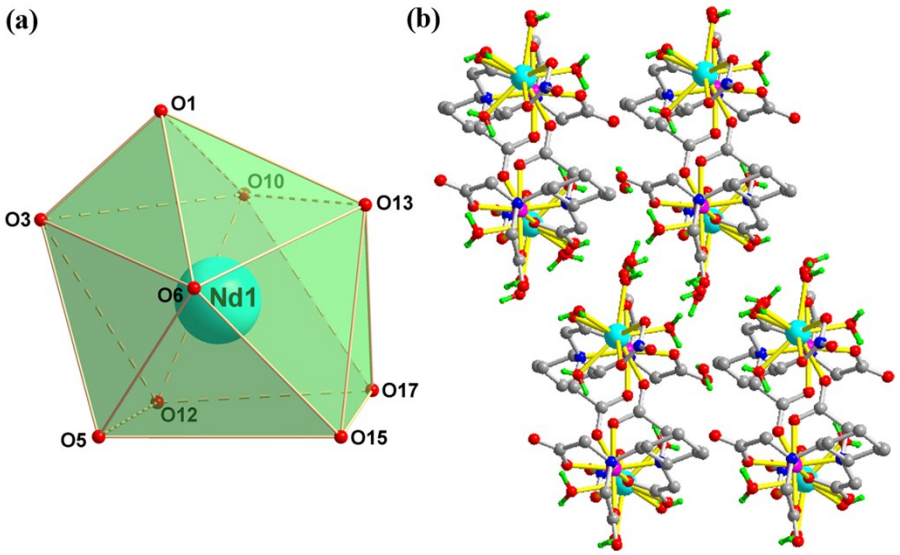

Fig. S2 (a) Coordination geometry of the Nd^{3+} ion in **1**. (b) The packing of the 0D tetranuclear clusters in the structure of **1**.

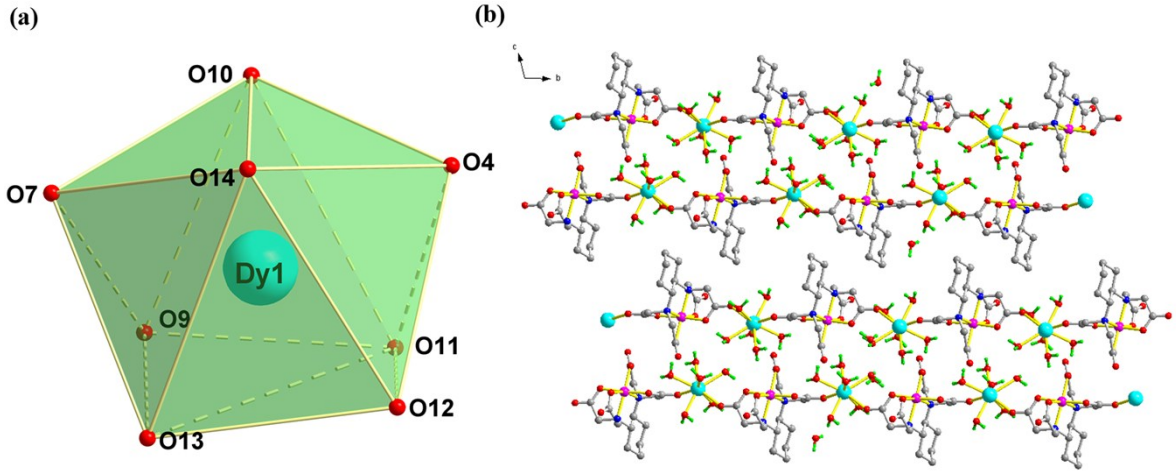

Fig. S3 (a) Coordination geometry of the Dy^{3+} ion in **3**. (b) Side view of 1D chain in the crystal of **3**.

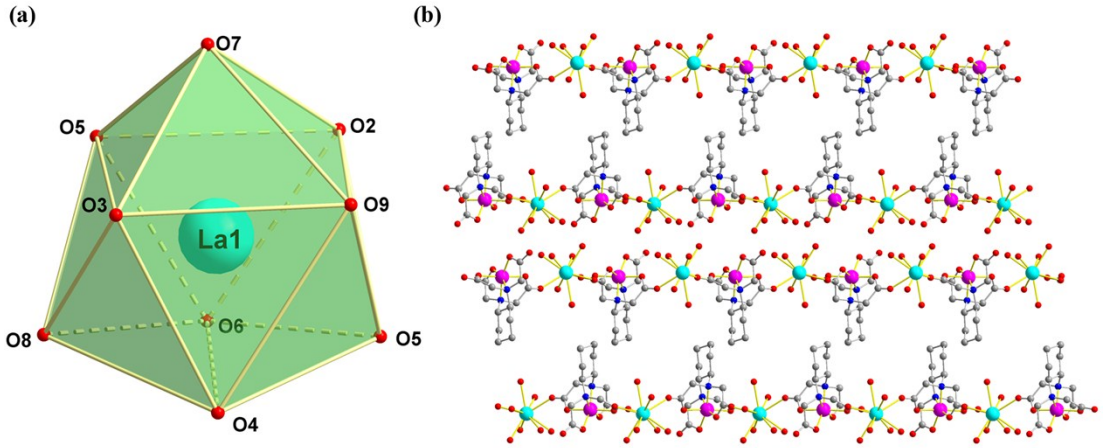

Fig. S4 (a) Coordination geometry of the La^{3+} ion in **4**. (b) The packing of 2D nets of **4**.

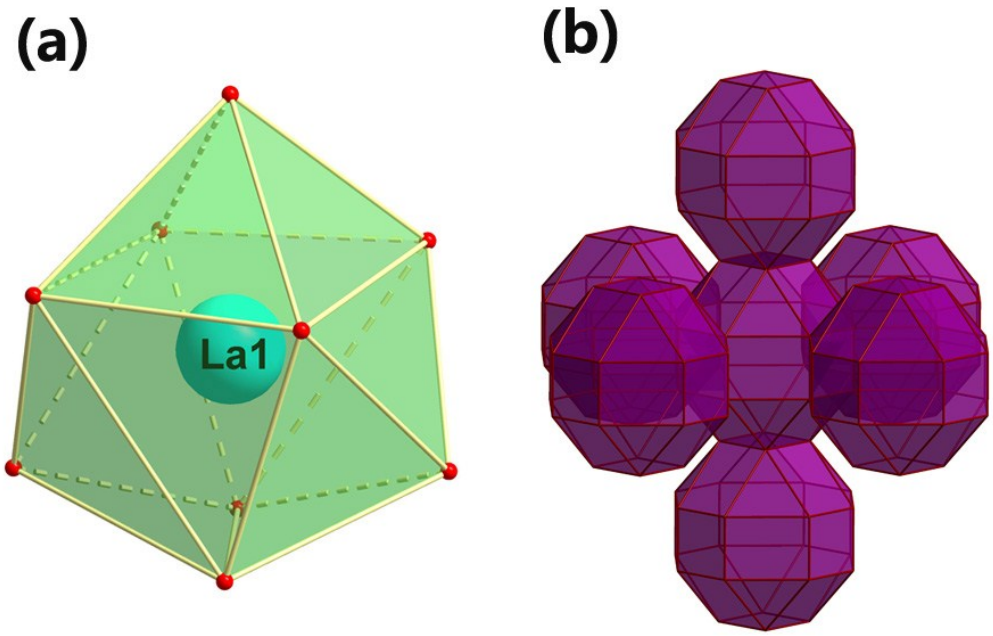

Fig. S5 (a) Coordination geometry of the La^{3+} ion in **6**. (b) The connecting plots of the La_{24} cages in **6**.

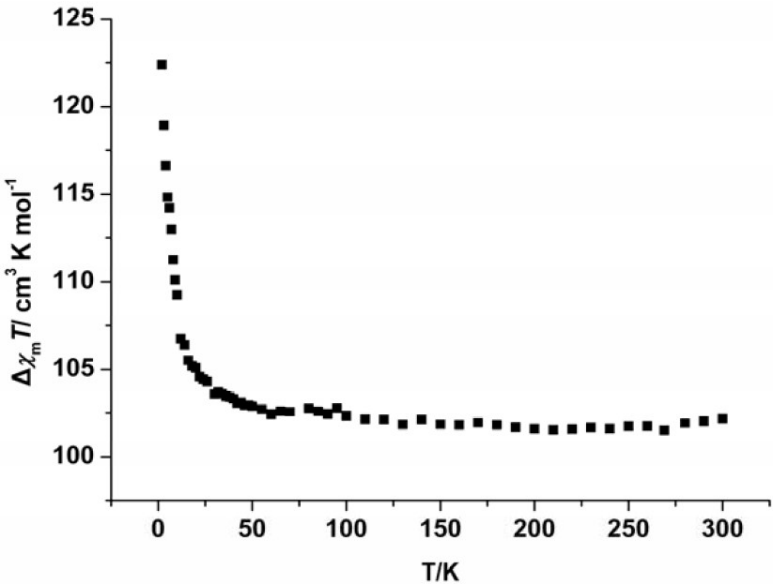

Fig. S6. The difference of $\chi_M T$($\Delta = (\chi_M T)$(**6**) – $(\chi_M T)$(**7**)) between compounds **6** and **7** versus *T*.

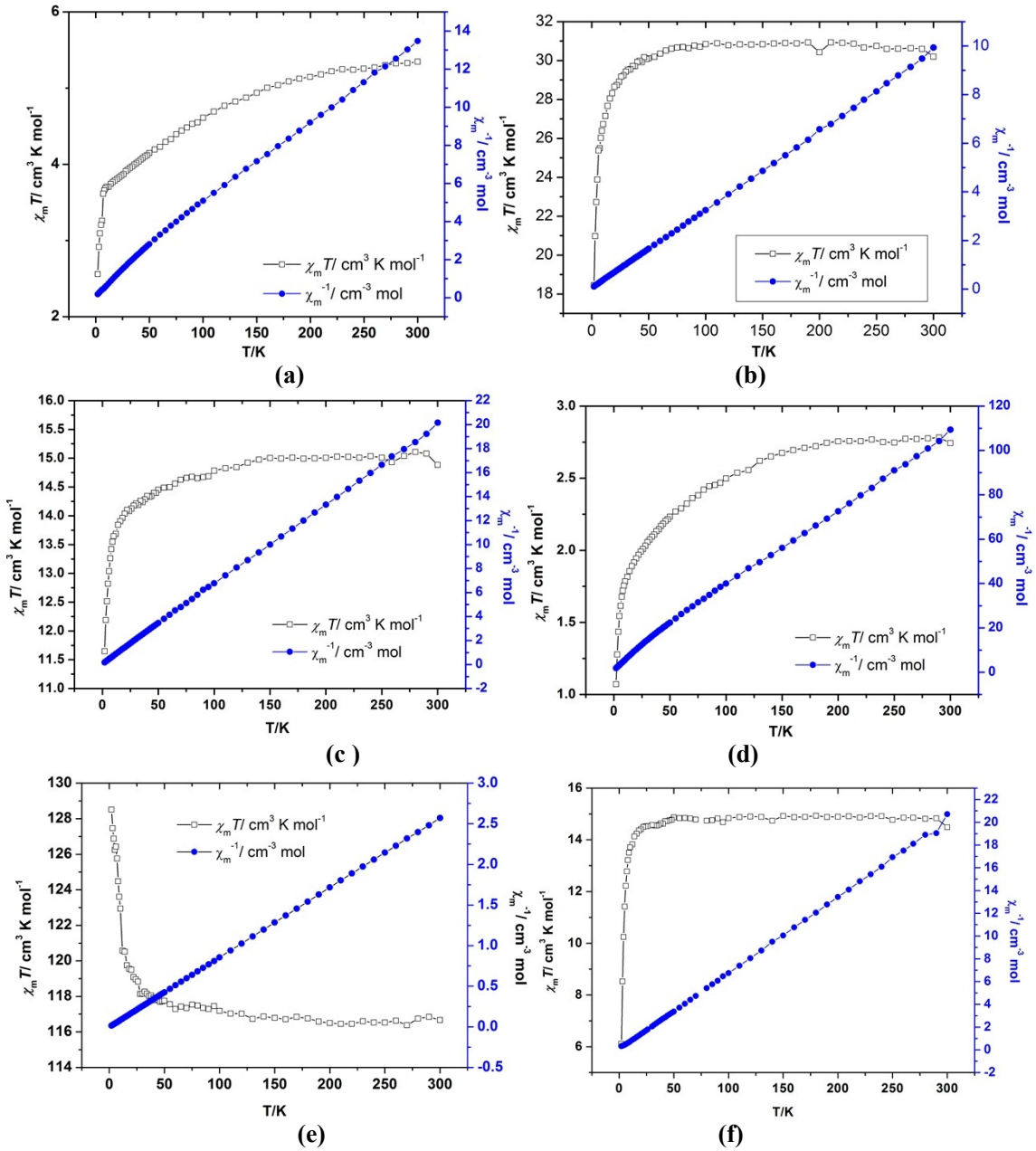

Fig. S7 Plots of $\chi_M T$ and χ_M^{-1} versus T for compounds 1 **(a), 2 (b), 3 (c), 5 (d), 6 (e) and 7(f)** over the temperature of range 2-300 K.

Table. S1: Selected bond lengths and angles (º) for 1 – 7.

complex **1**							
Nd1—O1	2.6187 (18)	Nd1—O3	2.5430 (19)	Nd1—O5	2.4748 (19)	Nd1—O6	2.489 (2)
Nd1—O10	2.421 (2)	Nd1—O12^{i}	2.4386 (19)	Nd1—O13	2.426 (2)	Nd1—O15	2.527 (2)
Nd1—O17	2.616 (2)	Nd1—N1	3.000 (3)	Ni1—O2	2.0371 (19)	Ni1—O3	2.1009 (19)
Ni1—O7	2.0197 (19)	Ni1—O9	2.0669 (18)	Ni1—N2	2.068 (2)	Ni1—N3	2.098 (2)
Ni1—O3—Nd1	153.33 (8)						
Symmetry codes: (i): -*x*+2, -y+2, -z+1							
complex **2**							
Dy1—O10	2.345 (4)	Dy1—O8	2.350 (4)	Dy1—O22^{i}	2.355 (4)	Dy1—O17	2.379 (4)
Dy1—O1	2.401 (4)	Dy1—O9	2.430 (4)	Dy1—O4	2.458 (4)	Dy1—O7	2.564 (5)
Dy1—O26	2.572 (4)	Ni1—O24	2.021 (4)	Ni1—O12	2.038 (4)	Ni1—O36	2.061 (4)
Ni1—N1	2.071 (5)	Ni1—N2	2.093 (4)	Ni1—O4	2.108 (4)		
Ni1—O4—Dy1	153.78 (18)						
Symmetry codes: (i): 1-*x*, -1-y, -z							
complex **3**							
Dy1—O10	2.360 (3)	Dy1—O4	2.289 (3)	Dy1—O7	2.355 (3)	Dy1—O14	2.314 (3)
Dy1—O12	2.372 (3)	Dy1—O11	2.430 (3)	Dy1—O13	2.332 (3)	Dy1—O9	2.367 (3)
Ni1—O1	2.066 (3)	Ni1—O3	2.028 (3)	Ni1—O8	2.037 (3)	Ni1—O5	2.053 (3)
Ni1—N1	2.060 (3)	Ni1—N2	2.075 (4)				
Symmetry codes: (i) *x*−1, *y*−1, *z*; (ii) *x*+1, *y*+1, *z*.							
complex **4**							
La1—O2^{i}	2.497 (3)	La1—O3^{ii}	2.516 (3)	La1—O5	2.443 (2)	La1—O4W	2.566 (3)
La1—O5W	2.556 (3)	La1—O6W	2.537 (3)	La1—O7W	2.632 (3)	La1—O8W	2.611 (2)
La1—O9W	2.548 (3)	Ni1—O1	2.058 (2)	Ni1—O4	2.019 (2)	Ni1—O6	2.019 (2)
Ni1—O8	2.066 (3)	Ni1—N2	2.079 (3)	Ni1—N1	2.070 (3)		
Symmetry codes: (i) *x*, *y*−1, z; (ii) *x*, −*y*+5/2, z+1/2;							
complex **5**							
Ni1—O4	2.015 (3)	Ni1—O6	2.020 (3)	Ni1—O2	2.058 (3)	Ni1—N1	2.062 (4)
Ni1—O8	2.071 (3)	Ni1—N2	2.080 (4)	Nd1—O5	2.401 (3)	Nd1—O1^{i}	2.435 (3)
Nd1—O3ii	2.472 (3)	Nd1—O7W	2.477 (3)	Nd1—O6W	2.479 (3)	Nd1—O8W	2.515 (4)
Nd1—O4W	2.518 (4)	Nd1—O5W	2.553 (3)	Nd1—O9W	2.576 (3)		
Symmetry codes: (i) *x*, *y*+1, *z*; (ii) *x*, −*y*−1/2, z+1/2;							
complex **6**							
Gd1—O1^{i}	2.45 (2)	Gd1—O3W	2.50 (2)	Gd1—O1^{ii}	2.45 (2)	Gd1—O1W^{iii}	2.78 (10)
Gd1—O1	2.45 (2)	Gd1—O1W	2.78 (10)	Gd1—O1^{iii}	2.45 (2)	Ni1—O2	1.95 (3)
Ni1—O2^{iv}	1.95 (3)	Ni1—O2^{v}	1.95 (3)	Ni1—O2^{vi}	1.95 (3)	Ni1—N1	2.05 (2)
Symmetry codes: (i) −*x*+1, −*z*, −*y*; (ii) *x*, −*z*, −*y*; (iii) −*x*+1, *y*, *z*; (iv) *y, x, z;* (v) *x, y, −z;* (vi) *y, x, −z*;							
complex **7**							
La1—O1	2.495 (7)	La1—O1^{iii}	2.495 (7)	La1—O1W	2.582 (9)	La1—O2W	2.609 (9)
Ni1—N1	2.019 (7)	La1—O1W^{i}	2.582 (9)	La1—O2W^{ii}	2.609 (9)	Ni1—N1^{iv}	2.019 (7)
La1—O1^{i}	2.495 (7)	La1—O1^{ii}	2.495 (7)				
Symmetry codes: (i) −*x*+1, *y, z*; (ii) *x, −z, −y;* (iii) −*x*+1, −*z, −y;* (iv) *y, x, −z*;							

Table S2 Hydrogen bond geometries for 1-5.

***D*-H…A**	***D*-H**	***A*…H**	***D*…*A***	***D*-H…*A***
Complex **1**				
O1W–H1WA…O4	0.87	2.07	2.923(3)	164.3
O1W–H1WB…O3W^{i}	0.87	2.14	2.980(3)	169.1
O2W–H2WB…O2	0.87	2.28	3.001(3)	143.4
O3W–H3WA…O1W^{i}	0.87	2.00	2.826(4)	165.3
Symmetry codes: (i): -*x*+2, -*y*+2, -*z*+1				
Complex **2**				
O1W–H1WA…O4	0.87	2.08	2.831(4)	163.5
O1W–H1WB…O3W^{i}	0.87	2.34	2.941(4)	170.1
O2W–H2WB…O2	0.87	2.16	3.121(2)	139.2
O3W–H3WA…O1W^{i}	0.87	2.11	2.745(4)	145.9
Symmetry codes: (i): 1-*x*, -1-*y*, -*z*				
Complex **3**				
O14W–H14WA…Cl1	0.88	2.48	3.238(3)	144.3
O10W–H10WA…Cl1	0.88	2.30	3.132(3)	156.5
O1W–H1WA…Cl1	0.87	2.28	3.140(2)	169.3
O1W–H1WB…Cl1^{i}	0.87	2.47	3.336(4)	175.1
Symmetry codes: (i): 1-*x*, 1-*y*, -*z*				
Complex **4**				
O7W–H7WB…O12	0.90	2.07	2.929(5)	158.6
O7W–H7WB…O11	0.90	2.73	3.473(6)	140.0
Complex **5**				
O7W–H7WB…O12	0.89	2.11	2.846(3)	159.2
O7W–H7WB…O11	0.89	2.69	3.124(4)	141.3