Electronic Supplementary Information (ESI) for

Syntheses, Structures, and Magenetic Properties of Six Coordination Polymers Based on 4,5-Di(4'-carboxylphenyl)phthalic Acid and Different Bis(imidazole) Bridging Linkers

Liming Fan,[a] Yan Gao,[b] Guangzeng Liu,[b] Weiliu Fan,[a] Weikuo Song,[b] Liming Sun,[a] Xian Zhao,*[a] Xiutang Zhang*[a,b]

[a] *State Key Laboratory of Crystal Materials, Shandong University, Jinan 250100, China.* [b] *Advanced Material Institute of Research, College of Chemistry and Chemical Engineering, Qilu Normal University, Jinan, 250013, China.*

E-mail: xiutangzhang@163.com; *zhaoxian@icm.sdu.edu.cn*.

ESI

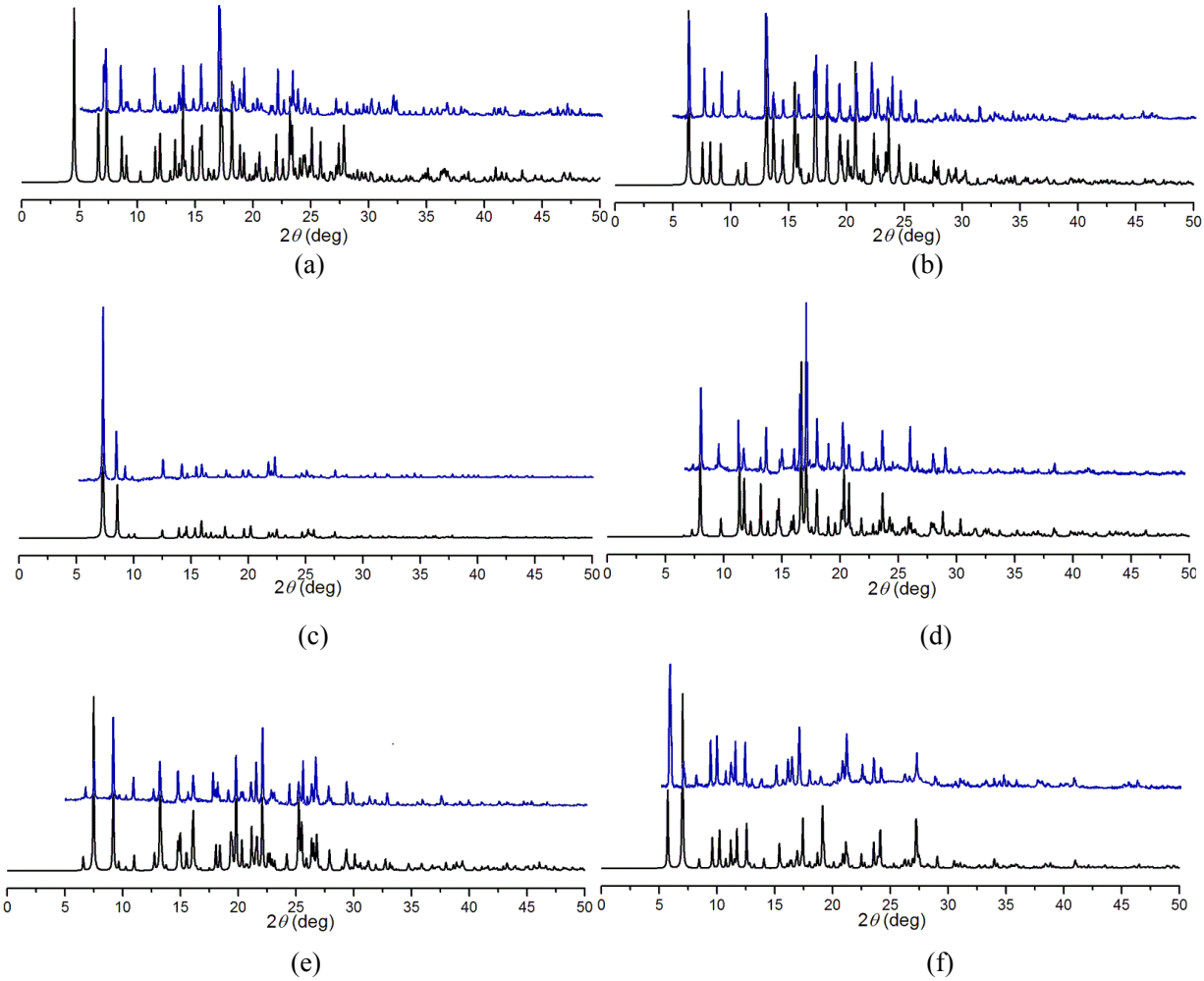
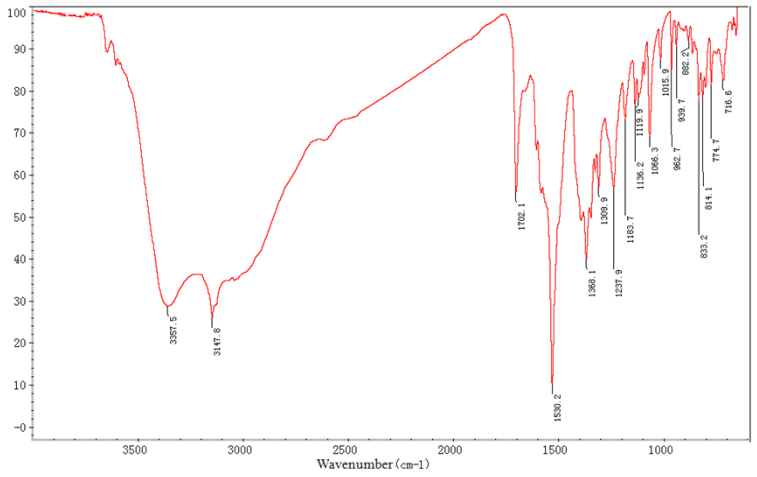
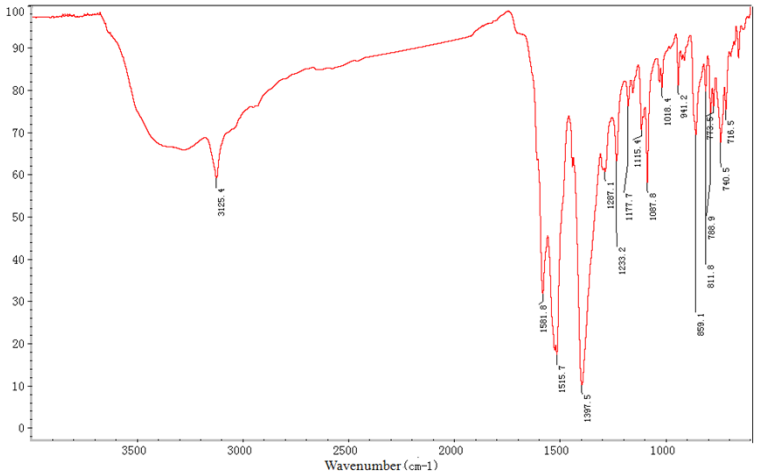


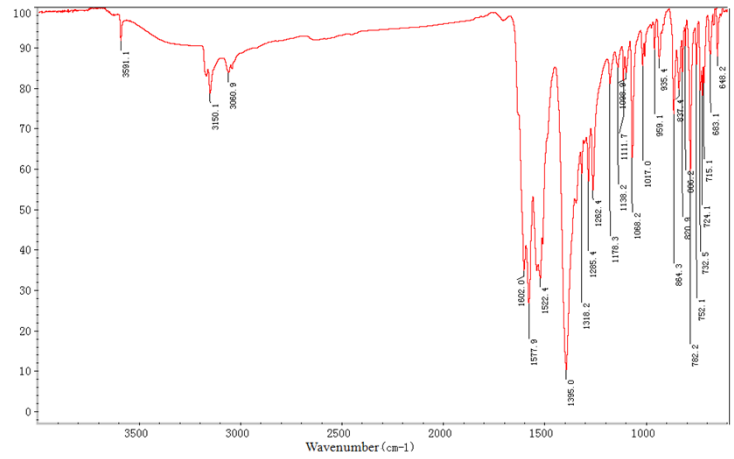
Figure S1. PXRD patterns of **1** (a), **2** (b), **3** (c), **4** (d), **5** (e) and **6** (f). Dark: calculated from the X-ray single-crystal data; Blue: observed for the as-synthesized solids.


3357.5
3147.8
1702.1
1530.2
1368.1
1309.9
1237.9
1183.7
1136.2
1066.3
1015.9
962.7
939.7
882.2
833.2
814.1
774.7
716.6
Wavenumber(cm-1)

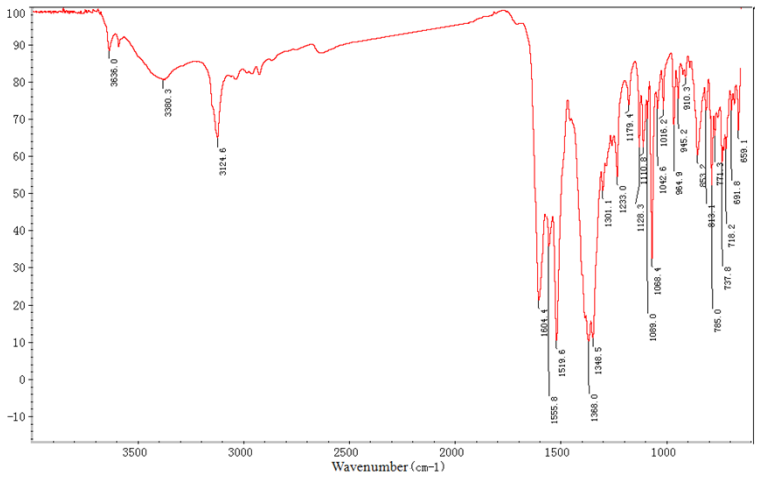
(a)


3125.4
1581.8
1515.7
1397.5
1287.1
1233.2
1177.7
1115.4
1067.8
1018.4
941.2
859.1
811.8
788.9
740.5
716.5
Wavenumber(cm-1)

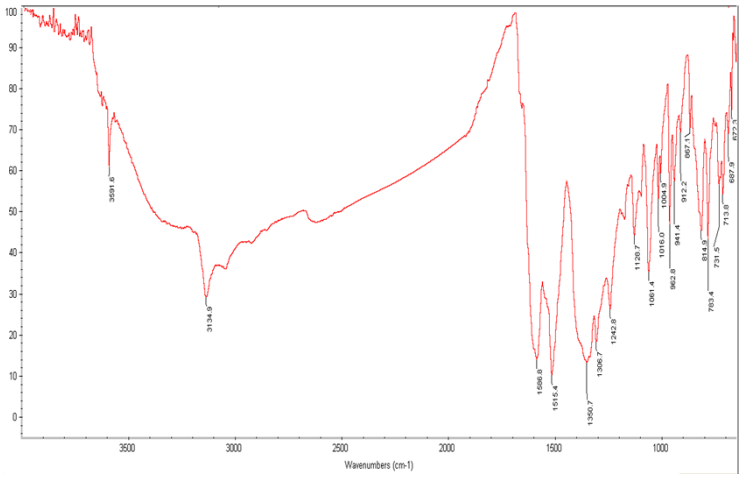
(b)


3591.1
3150.1
3060.9
1602.0
1577.9
1522.4
1395.0
1318.2
1285.4
1262.4
1178.3
1138.2
1111.7
1068.2
1017.0
959.1
935.4
894.3
827.4
782.2
752.1
732.5
724.1
715.1
683.1
648.2
Wavenumber(cm-1)

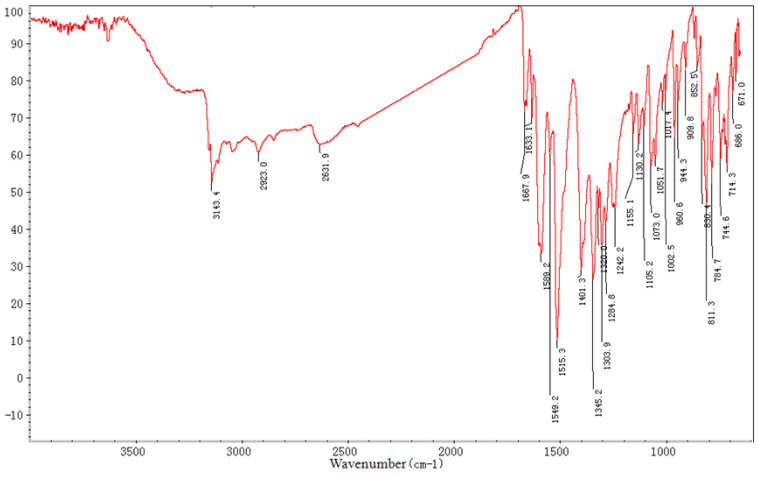
(c)



(d)



(e)



(f)

Figure S2. IR spectra of 1 (a), 2 (b), 3 (c), 4 (d), 5 (e), and 6 (f).

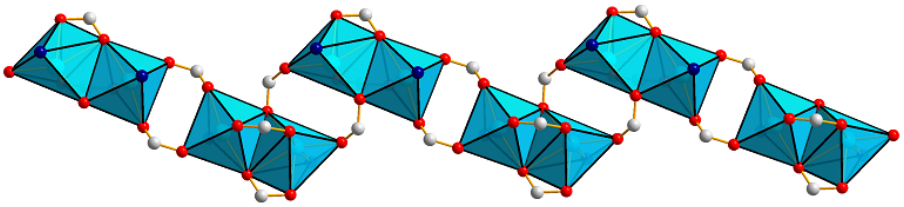


Figure S3. The $[Co_4(COO)_8]_n$ chain in complex **3**.

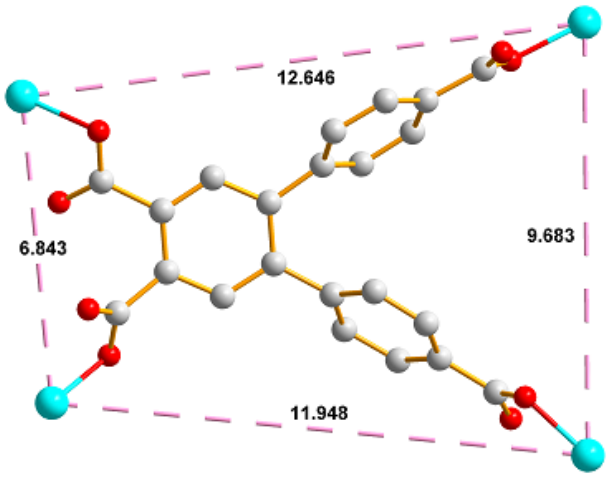


Figure S4. The Co···Co distacnes seperated by DCP^{4-} ligand in complex **4**.

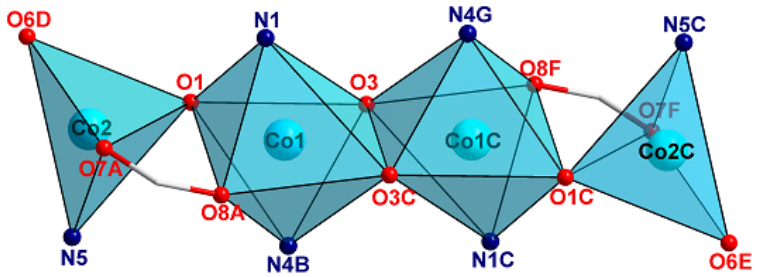


Figure S5. The $\{Co_4\}$ cluster based SBUs in complex **6**.

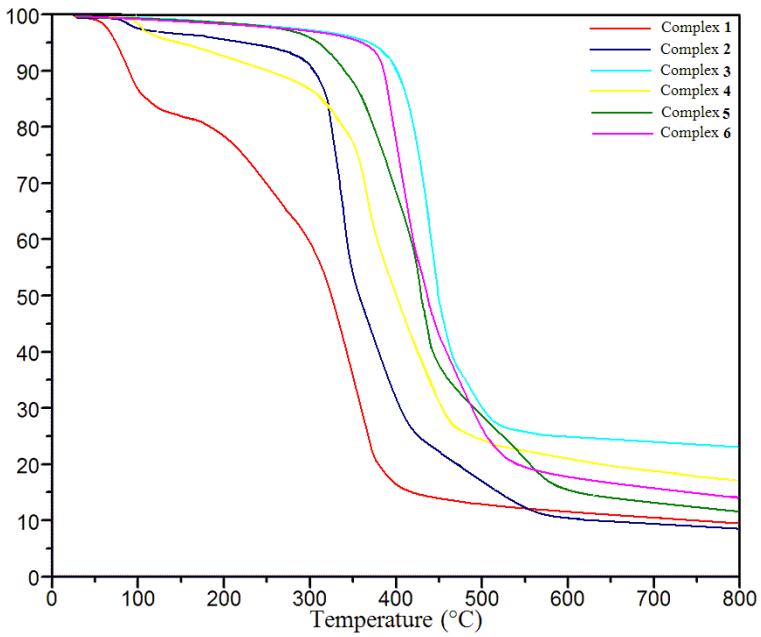


Figure S6. TG curves for complexes **1**-**6**.

Table S1 Selected bond lengths (Å) and angles (º) for **1 – 6**.

Complex **1**							
N(1)-Ni(1)	2.067(5)	N(3)-Ni(2)	2.080(5)	N(5)-Ni(2)	2.075(6)	Ni(2)-O(13)	2.065(2)
Ni(1)-O(9)	2.071(3)	Ni(2)-O(12)	2.074(2)	Ni(1)-O(1)	2.123(4)	Ni(2)-O(10)	2.083(2)
Ni(2)-O(11)	2.050(2)	N(1)-Ni(1)-O(9)	87.51(17)	N(1)$^{\#4}$-Ni(1)-O(1)	93.46(19)	N(1)-Ni(1)-O(1)	86.54(19)
N(1)-Ni(1)-O(9)$^{\#4}$	92.49(17)	O(9)-Ni(1)-O(1)	94.84(14)	O(11)-Ni(2)-O(13)	88.81(8)	O(11)-Ni(2)-O(12)	175.10(12)
O(9)$^{\#4}$-Ni(1)-O(1)	85.16(14)	O(11)-Ni(2)-N(5)	85.99(17)	O(13)-Ni(2)-N(5)	91.50(18)	O(12)-Ni(2)-N(5)	90.26(18)
O(13)-Ni(2)-O(12)	88.13(8)	O(13)-Ni(2)-N(3)	89.66(17)	O(12)-Ni(2)-N(3)	91.71(17)	N(5)-Ni(2)-N(3)	177.7(2)
O(11)-Ni(2)-N(3)	92.11(17)	O(13)-Ni(2)-O(10)	179.32(12)	O(12)-Ni(2)-O(10)	92.14(8)	N(5)-Ni(2)-O(10)	87.88(19)
O(11)-Ni(2)-O(10)	90.88(8)	N(3)-Ni(2)-O(10)	90.95(17)				
Symmetry codes: #4 -*x*, -*y*+1, -*z*+1.							
Complex **2**							
N(4)-Ni(1)	2.081(2)	N(5)-Ni(1)	2.077(2)	N(7)-Ni(1)	2.093(2)	Ni(1)-O(1)	2.0684(17)
Ni(1)-N(1)$^{\#4}$	2.098(2)	Ni(1)-O(9)	2.1178(19)	O(1)-Ni(1)-N(5)	84.10(8)	O(1)-Ni(1)-N(4)	176.93(8)
N(5)-Ni(1)-N(4)	97.57(8)	O(1)-Ni(1)-N(7)	94.33(8)	N(5)-Ni(1)-N(7)	90.62(8)	N(4)-Ni(1)-N(7)	88.24(8)
O(1)-Ni(1)-N(1)$^{\#4}$	88.48(8)	N(5)-Ni(1)-N(1)$^{\#4}$	95.19(8)	N(4)-Ni(1)-N(1)$^{\#4}$	88.80(8)	N(7)-Ni(1)-N(1)$^{\#4}$	173.78(8)
O(1)-Ni(1)-O(9)	84.86(7)	N(5)-Ni(1)-O(9)	168.22(8)	N(4)-Ni(1)-O(9)	93.64(8)	N(7)-Ni(1)-O(9)	86.10(9)
N(1)$^{\#4}$-Ni(1)-O(9)	88.63(9)						
Symmetry codes: #4 -*x*+3/2, *y*+1/2, -*z*+1/2.							
Complex **3**							
Co(1)-O(3)	2.012(3)	Co(1)-O(4)$^{\#1}$	2.048(3)	Co(1)-O(8)$^{\#2}$	2.079(3)	Co(1)-O(5)$^{\#3}$	2.111(3)
Co(1)-N(4)$^{\#4}$	2.138(3)	Co(1)-O(1)	2.281(2)	Co(2)-O(6)$^{\#3}$	2.023(3)	Co(2)-O(6)$^{\#3}$	2.023(3)
Co(2)-O(8)$^{\#2}$	2.338(3)	Co(2)-O(1)	2.084(2)	Co(2)-O(2)$^{\#5}$	2.027(3)	Co(2)-O(2)$^{\#5}$	2.027(3)
Co(2)-O(7)$^{\#2}$	2.162(3)	Co(2)-N(1)	2.067(3)	O(4)$^{\#1}$-Co(1)-O(8)$^{\#2}$	96.29(11)	O(4)$^{\#1}$-Co(1)-O(5)$^{\#3}$	85.96(11)
O(3)-Co(1)-O(8)$^{\#2}$	166.19(11)	O(3)-Co(1)-N(4)$^{\#4}$	93.58(12)	O(3)-Co(1)-O(5)$^{\#3}$	85.93(11)	O(8)$^{\#2}$-Co(1)-O(5)$^{\#3}$	89.70(11)
O(4)$^{\#1}$-Co(1)-N(4)$^{\#4}$	98.03(12)	O(5)$^{\#3}$-Co(1)-N(4)$^{\#4}$	176.01(12)	O(8)$^{\#2}$-Co(1)-O(1)	83.22(9)	N(4)$^{\#4}$-Co(1)-O(1)	83.44(11)
O(8)$^{\#2}$-Co(1)-N(4)$^{\#4}$	89.87(12)	O(3)-Co(1)-O(1)	83.89(9)	O(5)$^{\#3}$-Co(1)-O(1)	92.57(10)	O(3)-Co(1)-O(4)$^{\#1}$	96.47(11)
O(4)$^{\#1}$-Co(1)-O(1)	178.45(10)	O(6)$^{\#3}$-Co(2)-O(2)$^{\#5}$	82.34(11)	O(2)$^{\#5}$-Co(2)-O(1)	124.93(10)	O(2)$^{\#5}$-Co(2)-O(7)$^{\#2}$	95.94(11)
O(6)$^{\#3}$-Co(2)-N(1)	168.77(12)	N(1)-Co(2)-O(1)	93.48(11)	N(1)-Co(2)-O(7)$^{\#2}$	93.54(13)	O(6)$^{\#3}$-Co(2)-O(8)$^{\#2}$	93.34(11)
O(2)$^{\#5}$-Co(2)-N(1)	86.44(12)	O(6)$^{\#3}$-Co(2)-O(7)$^{\#2}$	88.04(12)	O(1)-Co(2)-O(7)$^{\#2}$	138.87(11)	O(2)$^{\#5}$-Co(2)-O(8)$^{\#2}$	153.02(10)
O(6)$^{\#3}$-Co(2)-O(1)	92.61(11)	O(1)-Co(2)-O(8)$^{\#2}$	81.73(9)	O(7)$^{\#2}$-Co(2)-O(8)$^{\#2}$	57.20(10)	N(1)-Co(2)-O(8)$^{\#2}$	96.86(11)
Symmetry codes: #1 -*x*+1, -*y*+1, -*z*+2. #2 *x*+1/2, -*y*+3/2, *z*+1/2. #3 *x*, -*y*+1, *z*+1/2. #4 *x*+1/2, *y*-1/2, *z*. #5 -*x*+1/2, -*y*+3/2, -*z*+2.							
Complex **4**							
Co(1)-O(4)$^{\#2}$	1.944(5)	Co(1)-N(1)	1.983(5)	Co(2)-O(5)$^{\#3}$	1.914(4)	Co(2)-O(1)	1.980(4)
Co(1)-N(5)	1.981(5)	Co(1)-O(3)$^{\#2}$	2.383(6)	Co(2)-N(8)$^{\#4}$	1.949(5)	Co(2)-N(4)$^{\#5}$	1.998(5)
O(7)-Co(1)-O(4)$^{\#2}$	111.0(2)	O(4)$^{\#2}$-Co(1)-N(5)	123.18(18)	O(4)$^{\#2}$-Co(1)-N(1)	113.3(2)	O(7)-Co(1)-O(3)$^{\#2}$	169.41(15)
O(7)-Co(1)-N(5)	104.4(2)	O(7)-Co(1)-N(1)	93.4(2)	N(5)-Co(1)-N(1)	107.2(2)	O(4)$^{\#2}$-Co(1)-O(3)$^{\#2}$	59.18(18)
N(5)-Co(1)-O(3)$^{\#2}$	85.33(19)	O(5)$^{\#3}$-Co(2)-N(8)$^{\#4}$	128.19(17)	N(8)$^{\#4}$-Co(2)-O(1)	110.76(18)	N(8)$^{\#4}$-Co(2)-N(4)$^{\#5}$	99.4(2)
N(1)-Co(1)-O(3)$^{\#2}$	87.59(19)	O(5)$^{\#3}$-Co(2)-O(1)	102.24(17)	O(5)$^{\#3}$-Co(2)-N(4)$^{\#5}$	110.6(2)	O(1)-Co(2)-N(4)$^{\#5}$	103.44(18)
Symmetry code: #2 *x*+1, -*y*+1/2, *z*+1/2. #3 *x*, -*y*+1/2, *z*-1/2. #4 *x*-1, *y*-1, *z*-1. #5 *x*, *y*-1, *z*.							
Complex **5**							
Co(1)-O(2)	1.994(2)	Co(1)-O(8)$^{\#2}$	2.045(2)	Co(1)-N(1)	2.112(3)	Co(1)-N(4)$^{\#3}$	2.106(3)
Co(1)-O(7)$^{\#1}$	2.031(2)	O(2)-Co(1)-O(7)$^{\#1}$	103.03(11)	O(2)-Co(1)-N(4)$^{\#3}$	89.15(10)	O(2)-Co(1)-N(1)	84.20(10)
O(8)$^{\#2}$-Co(1)-N(1)	86.67(9)	O(2)-Co(1)-O(8)$^{\#2}$	129.58(11)	O(7)$^{\#1}$-Co(1)-N(4)$^{\#3}$	94.38(10)	O(7)$^{\#1}$-Co(1)-N(1)	88.37(10)
N(4)$^{\#3}$-Co(1)-N(1)	173.23(10)	O(7)$^{\#1}$-Co(1)-O(8)$^{\#2}$	126.17(10)	O(8)$^{\#2}$-Co(1)-N(4)$^{\#3}$	96.64(10)		
Symmetry code: #1 -*x*, -*y*, -*z*+2. #2 *x*+1, *y*, *z*-1. #3 *x*-1, *y*-1, *z*.							
Complex **6**							
Co(1)-O(8)$^{\#1}$	2.088(2)	Co(1)-N(4)$^{\#2}$	2.118(3)	Co(1)-O(3)$^{\#3}$	2.192(2)	Co(1)-O(1)	2.197(2)
Co(1)-N(1)	2.111(3)	Co(1)-O(3)	2.166(2)	Co(2)-O(7)$^{\#1}$	1.976(2)	Co(2)-O(1)	2.016(2)
Co(2)-N(5)	2.021(3)	Co(2)-O(6)$^{\#4}$	1.982(3)	O(8)$^{\#1}$-Co(1)-N(1)	88.11(10)	N(1)-Co(1)-N(4)$^{\#2}$	172.23(10)
N(1)-Co(1)-O(3)	101.38(9)	N(4)$^{\#2}$-Co(1)-O(3)	85.37(9)	O(8)$^{\#1}$-Co(1)-N(4)$^{\#2}$	85.82(9)	O(8)$^{\#1}$-Co(1)-O(3)	167.12(8)
N(4)$^{\#2}$-Co(1)-O(3)$^{\#3}$	85.76(9)	O(3)-Co(1)-O(3)$^{\#3}$	79.08(8)	N(4)$^{\#2}$-Co(1)-O(1)	91.45(9)	O(3)$^{\#3}$-Co(1)-O(1)	170.49(8)
O(8)$^{\#1}$-Co(1)-O(3)$^{\#3}$	90.90(8)	O(8)$^{\#1}$-Co(1)-O(1)	97.97(8)	O(3)-Co(1)-O(1)	91.64(8)	N(1)-Co(1)-O(1)	84.58(9)
N(1)-Co(1)-O(3)$^{\#3}$	99.20(9)	O(7)$^{\#1}$-Co(2)-O(6)$^{\#4}$	97.37(11)	O(6)$^{\#4}$-Co(2)-O(1)	109.43(10)	O(6)$^{\#4}$-Co(2)-N(5)	136.63(13)
O(7)$^{\#1}$-Co(2)-O(1)	106.13(10)	O(7)$^{\#1}$-Co(2)-N(5)	98.76(11)	O(1)-Co(2)-N(5)	104.21(10)		
Symmetry code: #1 *x*, -*y*+1, *z*+1/2. #2 *x*-1/2, *y*+1/2, *z*. #3 -*x*+1, -*y*+1, -*z*+1. #4 -*x*+3/2, -*y*+3/2, -*z*+1.							