Electronic Supplementary Information

Wheel-type Heterometallic Ferromagnetic Clusters: $[Ni_{7-x}M_x(HL)_6(\mu_3\text{-}OMe)_4(\mu_3\text{-}OH)_2]Cl_2$ (M = Zn, Co, Mn; x = 1, 3)

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Table S1. Synthetic details and estimated compositions for **1–7**.

Substrates for synthesis of $[Ni_{7-x}M_x]$									
x	Amount of Ni^{II}		Amount of Zn^{II}		Amount of Co^{II}		Amount of Mn^{II}		Nominal composition of cluster core
	[mmol]	[mg]	[mmol]	[mg]	[mmol]	[mg]	[mmol]	[mg]	
0	1.17	277	-	-	-	-	-	-	$[Ni_7]$
1	1.0	237	0.17	23.2	-	-	-	-	$[Ni_6Zn]$
1	1.0	237	-	-	0.17	40.4	-	-	$[Ni_6Co]$
1	1.0	237	-	-	-	-	0.17	33.6	$[Ni_6Mn]$
3	0.67	158	0.5	68.2	-	-	-	-	$[Ni_4Zn_3]$
3	0.67	158	-	-	0.5	119.0	-	-	$[Ni_4Co_3]$
3	0.67	158	-	-	-	-	0.5	99.0	$[Ni_4Mn_3]$

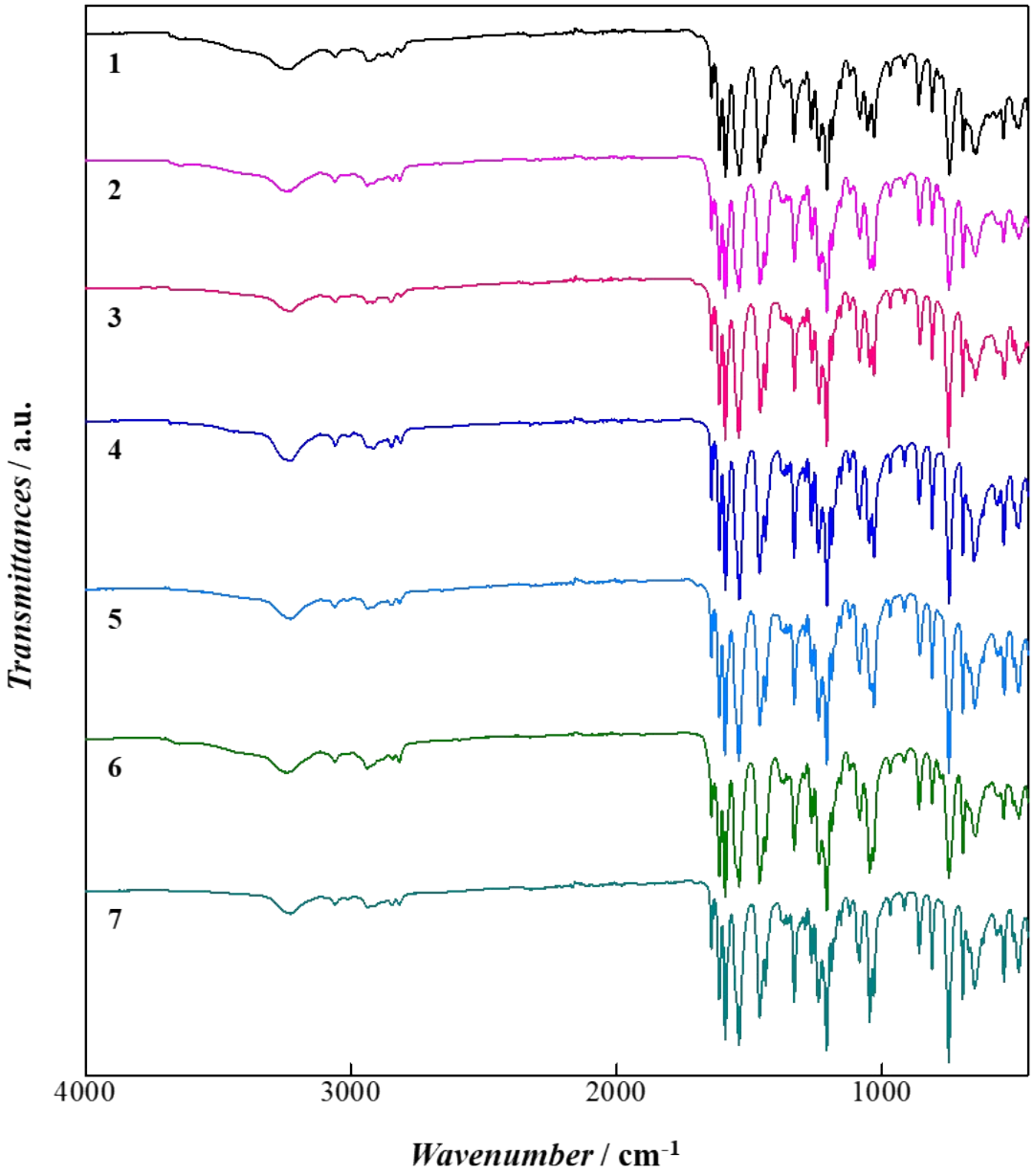

Figure S1. FT-IR spectra for **1**–**7**.

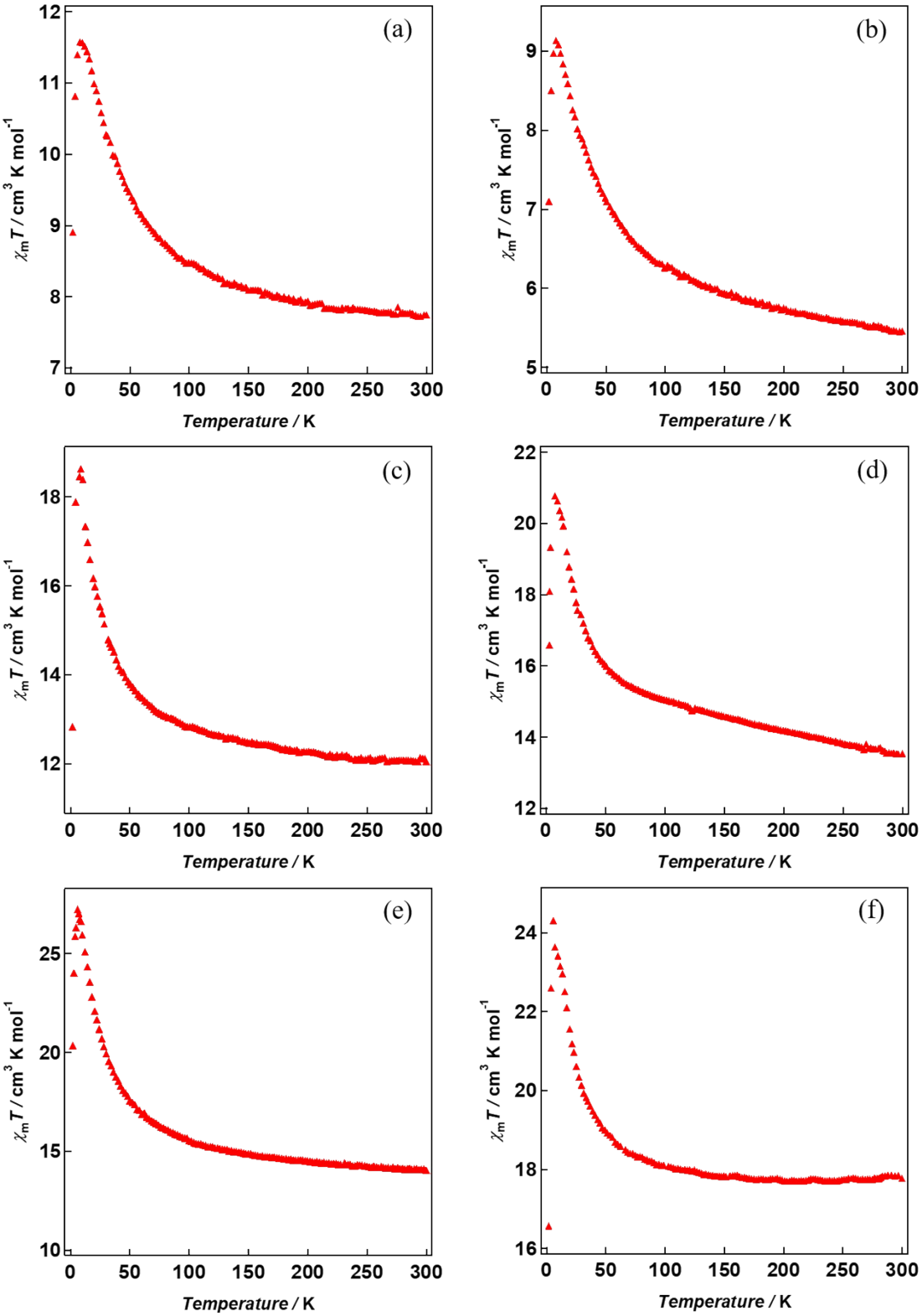

Figure S2. Magnetic behaviors for (a) **2**, (b) **3**, (c) **4**, (d) **5**, (e) **6**, (f) **7**.

Table S2. Crystallographic data for **2** after PLATON SQUEEZE treatment.[1] An additional methanol molecule was added to the final formula.

Compound	**2·3CH$_3$OH**
formula	$C_{109}H_{128}Ni_6ZnN_{12}O_{27}Cl_2$
formula weight	2526.76
crystal system	cubic
space group	$Pa\bar{3}$
a / Å	22.6686(17)
b / Å	22.6686(17)
c / Å	22.6686(17)
α / °	90
β / °	90
γ / °	90
V / Å^3	11648.6(15)
Z	4
T / K	123
$R1$	0.0710
w$R2$	0.2507
G.O.F.	1.041
CCDC	1853458

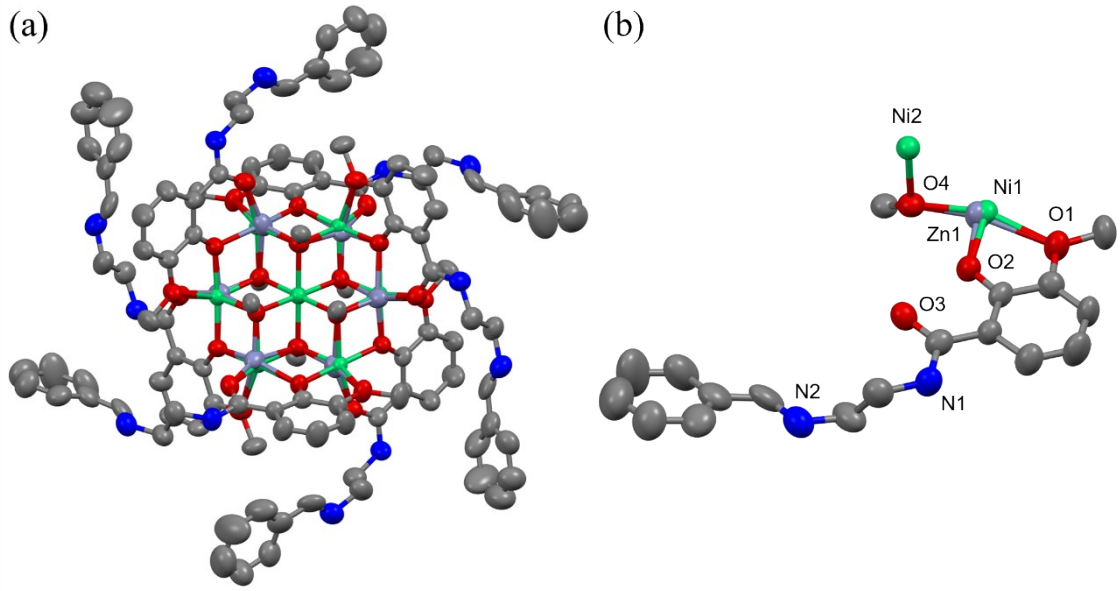

Figure S3. (a) Crystal structure and (b) an asymmetric unit of Ni_6Zn (**2·3CH$_3$OH**) at 123 K. Ni1 and Zn1 atoms are existed in 0.83333:0.16667 disorder occupancy ratio. All disordered atoms, hydrogen atoms, counter anions, and solvent molecules are omitted for clarity.

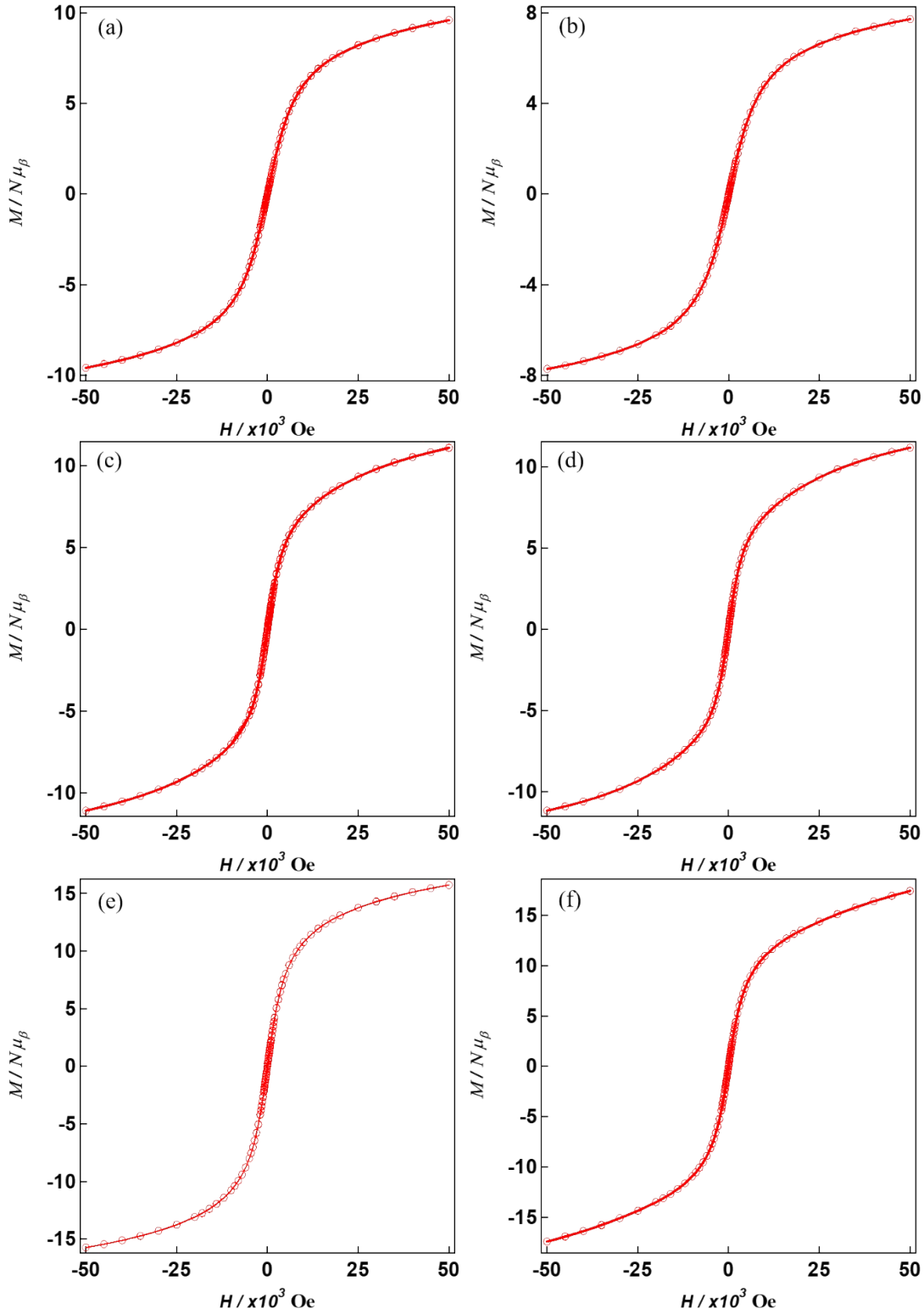

Figure S4. Magnetizations for (a) **2**, (b) **3**, (c) **4**, (d) **5**, (e) **6**, (f) **7**.

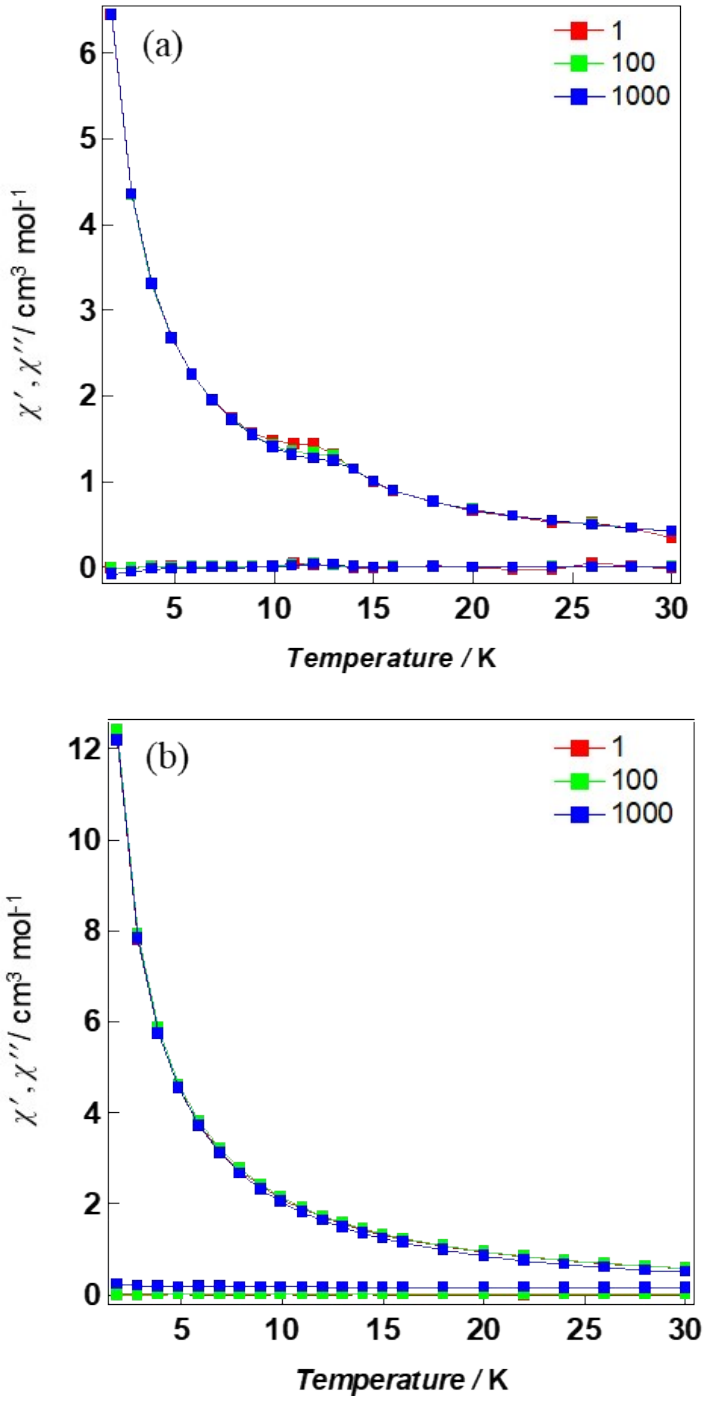

Figure S5. Temperature dependence of alternate current (ac) magnetic susceptibilities measured at H_{ac} = 3 Oe for (a) Ni_7; **1**, (b) Ni_4Mn_3; **7**.

Reference in ESI

(1) A. L. Spek, *J. Appl. Cryst.*, 2003, **36**, 7−13.