Magnetic properties of tetranuclear cobalt(II) cluster with pyridine alcoholate ligand

Substance

Tetranuclear cobalt(II) cluster with dipyridyl ketone;
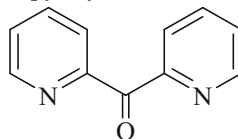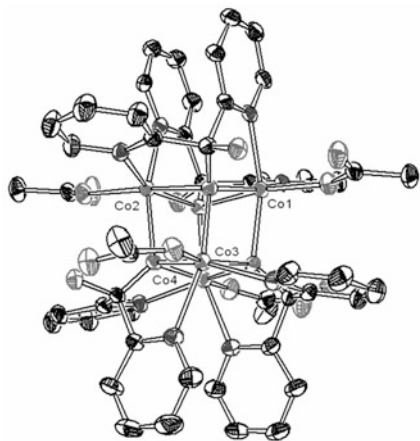$\{Co_4[OC(OH)(2\text{-pyridyl})_2[OAc]_4\}.7H_2O$

Gross Formula

$C_{52}H_{64}Co_4N_8O_{24}$

Properties

Molar magnetic susceptibility, product of molar magnetic susceptibility with temperature, Weiss constant and exchange energy

Structure

{Co$_4$[OC(OH)(2-pyridyl)$_2$[OAc]$_4$}.7H$_2$O;   2-pyridyl = 2-pyridylketone

Data

T [K]	χ_M [cm^3 mol^{-1}]	$\chi_M T$ [cm^3 K mol^{-1}]	p_m or μ_{eff} [μ_B]	Θ_P [K]	Method	Remarks
293	0.0232	6.53	3.63/Co	−69.29	–	cubane core
25	0.0751	3.02				

T: Temperature
χ_g: Specific susceptibility
χ_M: Molar susceptibility
p_m, μ_{eff}: Effective magnetic moment per molecule
Θ_P: Paramagnetic Curie constant (Weiss constant)

Additional Remarks

(i) Plot of χ_M^{-1} versus T is shown in Fig. 1 whereas plts of χ_M versus T and $\chi_M T$ versus T are shown in Fig. 2

(ii) Magnetic behavior (<100 K) indicated antiferromagnetic interactions

(iii) Curie-Weiss behavior observed, with:
$C = 8.14$ cm^3 K mol^{-1}
$\theta = -69.26$ K

(iv) Various coupling constants obtained were:
$J_1 = -21.86$ cm^{-1}
$J2 = {}^-14.81$ cm^{-1}
$J_3 = -10.55$ cm^{-1}
$g = 2.03$

Fig. 1 {Co$_4$[OC(OH)(2-pyridyl)$_2$[OAc]$_4$}.7H$_2$O. Temperature dependence of χ_M^{-1}. The solid line represents the best-fit curve
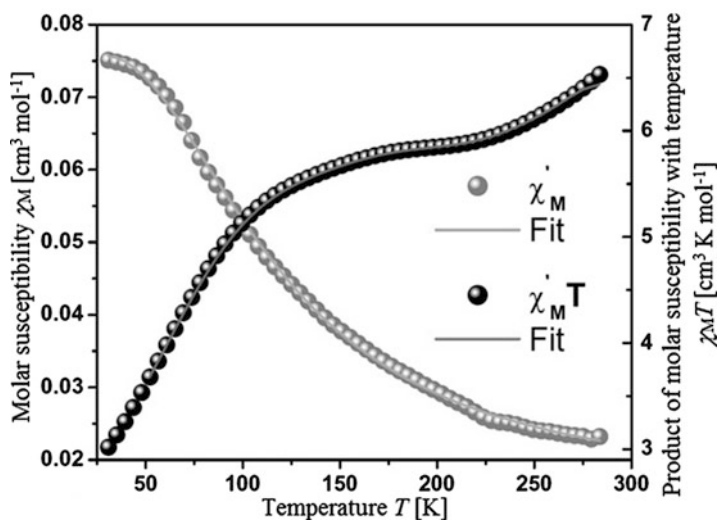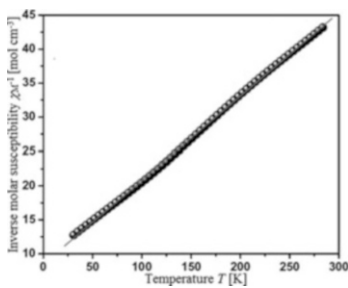
Fig. 2 {Co$_4$[OC(OH)(2-pyridyl)$_2$[OAc]$_4$}.7H$_2$O. Temperature dependence of χ_M and $\chi_M T$. The solid line represents the best-fit curve

Symbols and Abbreviations

Short form	Full form
T	temperature
χ_g	magnetic susceptibility per gram (specific susceptibility)
χ_M	magnetic susceptibility per mole (molar susceptibility)
p_m	effective magnetic moment per molecule
μ_{eff}	effective magnetic moment
Θ_P	paramagnetic Curie constant (Weiss constant)
χ_M^{-1}	inverse molar susceptibility
g	Lande factor
θ	Curie constant
C	Curie temperature

Reference

S.K. Padhi, R. Sahu, Polyhedron **27**, 2662 (2008)