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Dinuclear Copper(II) Complex, Super-exchange Interactions, Antiferromagnetic Coupling

\[ \text{[Cu}_2\text{(L)(O}_2\text{CMe)}\text{]}\cdot\text{H}_2\text{O (L = 1,3-Bis(2-Hydroxy-1-napthylideneamino)propan-2-ol)} \]

was synthesized and its crystal structure determined. \((\text{C}_{27}\text{H}_{23}\text{N}_2\text{O}_5\text{Cu}_2)\cdot\text{H}_2\text{O}\), monoclinic, space group \(P2_1/c\), \(a = 11.795(3)\), \(b = 17.988(5)\), \(c = 12.005(6)\) Å, \(\beta = 109.99(3)^\circ\), \(V = 2393(2)\) Å\(^3\), \(Z = 4\). Two copper(II) ions in a square-planar coordination are bridged by alkoxide and acetate oxygen atoms to form a dinuclear unit. The metal coordination sphere is four-coordinate, planar with an NO\(_3\) donor set. The dihedral angle between the two coordination planes is 6.34(9)\(^\circ\).

The copper(II) centers are separated by 3.492(2) Å and weakly antiferromagnetically coupled \((-2J = 163.6\text{ cm}^{-1})\), which follows from temperature-dependent magnetic susceptibility measurements in the temperature range 4.6 to 310 K. The Cu-O-Cu angle is 133.5(1)\(^\circ\) in the super-exchange pathway. The weak antiferromagnetic coupling of the complex is interpreted in terms of countercomplementary effects of the different bridging ligands which participate in the super-exchange interaction. The magnetic moment at 310 K is \(~2.7\) B. M., but \(~0.2\) B. M. at 4.6 K. The magnetic susceptibility is at a maximum near 140 K and decreases rapidly as the temperature is lowered to liquid helium temperature.