Synthesis, Crystal Structure and Magnetic Properties of a Novel Gd^{III}-Cu^{II} Heterodinuclear Complex

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Preparation, crystal structure and magnetic properties of a heterodinuclear complex, $LCu(Me_2CO)Gd(NO_3)_3$ (L = (N,N'-bis(3-methoxysalicylidene)propane-1,2-diamine) are reported. The crystal structure of the complex was determined by X-ray diffraction methods at 200 K. $(C_{19}H_{22}N_2O_4)Cu(C_3H_6O)Gd(NO_3)_3$, monoclinic, space group $P2_1/c$, with a = 9.795(9), b = 18.763(3), c = 15.579(2) Å, β = 95.297(2) V = 2850.9(7) $Å^3$ and Z = 4. The central region of the complex is occupied by Cu(II) and Gd(III) ions which are bridged by two phenolato oxygen atoms of the ligand. The copper ion adopts a square-based 4+1 coordination mode, the equatorial N_2O_2 donors being afforded by the ligand while the axial position is occupied by an oxygen atom of the acetone molecule. The Gd(III) ion is deca-coordinated. In addition to the two phenolate oxygen atoms, the coordination sphere contains two oxygen atoms of the OMe side arms of L and six oxygen atoms from the three bidentate nitrate ions. The Gd. . . Cu separation is 3.425(3) Å and the dihedral angle between the GdO(1)Cu and GdO(2)Cu planes is 164.8°. The magnetic susceptibility of the complex was measured over the range 5 - 350 K and the observed data were successfully simulated by the equation based on the spin-Hamiltonian operator ($\mathbf{H} = -J\mathbf{S}_{Cu}\cdot\mathbf{S}_{Gd}$), giving the exchange integral J(Cu-Gd) = 5.6(1) cm^{-1}. This indicates a weak ferromagnetic spin exchange interaction. The nature of the magnetic super-exchange interaction of the title compound is compared with similar [Gd(III)-Cu(II)] heterodinuclear complexes.