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Quantum effects in S=1/2 two-dimensional Heisenberg antiferromagnet in applied magnetic field

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Two-dimensional (2D) quantum antiferromagnets are of great fundamental interest because the presence of quantum fluctuations can lead to novel quantum excitations and novel ground states. Only little is known about the effects of applied magnetic fields on 2D square-lattice antiferromagnets. Using neutron scattering technique, we studied the magnetic excitation spectrum of the S=1/2 2D square-lattice Heisenberg antiferromagnet $Cu(pz)_2(ClO_4)_2$ [1] up to one third of saturation field. Inelastic neutron scattering measurements performed at zero field show 11.5(7)% dispersion along the antiferromagnetic zone-boundary and the existence of a magnetic continuum for wave-vectors around (π;0). Relatively small magnetic fields applied perpendicular to the square-lattice plane suppress the continuum and at H=14.9T the dispersion along the zone-boundary is inversed with respect to zero field with a minimum at (π/2;π/2). Due to quantum correlations magnetic fields strongly renormalize the entire excitation spectrum from factor Zc=1.19(2) at zero field to Zc=0.99(2) at H=14.9T. Renormalized spin wave theory describes the field dependence of the gap energy at the antiferromagnetic zone centre (π;π) with a small exchange anisotropy, but the dispersion of a well defined mode at high fields deviates from spin-wave theory, indicating the presence of quantum fluctuations.

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Keywords: quantum magnetism in low dimensions, inelastic neutron scattering, magnetic materials

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Assembling strategy of magnetic Mn complexes to design solid state multifunctional hybrid materials

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Two typical assembling or aggregation strategies to design multifunctional hybrid materials have been compared for modified chiral or single-molecule magnets based (SMM) of well-known magnetic Mn complex systems. Strategy I: Organic/inorganic hybrid materials of solid polymer films with photochromic azobenzene (AZ) and magnetic Mn complexes. It is valid for Mn12 SMM [1] forming structurally-determined compositions of photochromic AZ and magnetic moieties as well as mixed solutions in cast films [2,3], but it is limited for assembling or decomposition of coupled structures [4]. Strategy II: Stepwise assembling of potentially thermally-accessible crystalline Mn(III) complexes. Magnetic properties or ground spin states may be changed for mononuclear one [5]. It is partly valid for chiral Schiff base complexes of cyanide-bridged Mn-M'-Mn clusters [6], but the degree of distortion is small in cocrystals (Figure) [7].

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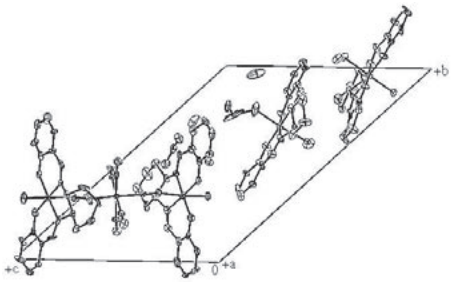

Keywords: materials chemistry, magnetochemistry, cocrystals

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Studies on some manganese-containing single-molecule magnets

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The synthesis, crystal structure, and magnetic properties of $[Mn_4O_2(OOCCMe_3)_6(bpy)_2]$ (**1**, bpy = 2,2'-bipyridine) and $[Mn_4O_2(OOCCMe_3)_6(phen)_2]$ (**2**, phen = 1,10-phenanthroline), are reported. Complexes **1** and **2** crystallize in the monoclinic P21/c space group and contain a known $[Mn^{III}_2Mn^{II}_2(\mu_3\text{-}O)_2]^{6+}$ core that can be considered as two edge-sharing, triangular $[Mn_3O]$ units. Peripheral ligation is by six μ_2-O_2CCMe_3 and two terminal bipy/phen groups to yield a complex with imposed *C*i symmetry. The magnetic properties of Complexes **1** and **2** have been studied by direct current (DC) and alternating current (AC) magnetic susceptibility techniques.

Keywords: single-molecule magnets, manganese complexes, magnetic susceptibility studies

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Slow relaxation of the magnetization in rationally designed single chain magnets

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After the intense research activity in the field of slow dynamics of the magnetization in molecular clusters (SMMs) and the bistability