High field level crossing studies on spin dimers in the low dimensional quantum spin system $Na_2T_2(C_2O_4)_3(H_2O)_2$ with T=Ni,Co,Fe,Mn

In this paper we demonstrate the application of high magnetic fields to study the magnetic properties of low dimensional spin systems. We present a case study on the series of 2-leg spin-ladder compounds $Na_2T_2(C_2O_4)_3(H_2O)_2$ with T = Ni, Co, Fe and Mn. In all compounds the transition metal is in the T2+ high spin configuation. The localized spin varies from S=1 to 3/2, 2 and 5/2 within this series.
The magnetic properties were examined experimentally by magnetic susceptibility, pulsed high field magnetization, specific heat measurements and high-field ESR. The data are analysed using a spin hamiltonian description. Although the transition metal ions form structurally a 2-leg ladder, an isolated dimer model consistently describes the observations very well. This behaviour can be understood in terms of the different coordination and superexchange angles of the oxalate ligands along the rungs and legs of the 2-leg spin ladder.
All compounds exhibit magnetic field driven ground state changes which at very low temperatures lead to a multistep behaviour in the magnetization curves. In the Co and Fe compounds a strong axial anisotropy induced by the orbital magnetism leads to a nearly degenerate ground state and a strongly reduced critical field. We find a monotonous decrease of the intradimer magnetic exchange if the spin quantum number is increased.

See C. Mennerich et al., Phys. Rev. B **73** 174415 (2006)
C. Mennerich et al., J. Magn. Magn. Mater., accepted, doi:10.1016/j.jmmm.2006.10.385 (2006)
C.Mennerich et al. cond-mat/0701575, accepted to appear in Springer “Lecture Notes in Phyiscs”