MAGNETOSTRUCTURAL CORRELATIONS IN TRANSITION METAL COMPLEXES AND MAGNETIC NANOPARTICLES

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The analysis and understating of magnetostructural correlations are a prerequisite for a synthesis of materials with prescribed magnetic properties. And vice versa: understanding magnetostructural correlations enables a better insight into the structure and chemical bonds of the material for which the magnetic properties were previously experimentally determined.

Experimental procedure for the determination of temperature and magnetic field dependence of magnetic properties of solids on a Quantum Design MPMS magnetometer will be briefly described.

Transition metal complexes are one of the most studied materials for analysis of magnetostructural correlations due to their relatively simple magnetic structure with only few magnetic ions in a unit cell, while the units are well separated by non-magnetic ions. In this way the magnetic interactions are restricted to a unit cell (intramolecular interactions), while interaction between magnetic ions from different units (intermolecular interactions) are usually negligible.

Through the examples, we will describe magnetic properties of a simple mononuclear units with different transition metal ions [1], a low spin – high spin transition of Ni(II) ions in a nickel complex [2] as shown in Fig. 1, and selected polynuclear complexes, where intramolecular interactions need to be taken into account in order to adequately describe their magnetic properties [3,4].

A temperature dependent susceptibility $\chi(T)$ of a complex composed of dinuclear Cu(II) units (Bleaney-Bower equation) will be compare to a structurally similar complex with Cu(II) ions arranged in the chains (Bonner-Fisher model) [5].

Magnetic properties of magnetic nanoparticles are strongly influenced by the size distribution of the investigated nanoparticles [6]. We have developed a Monte Carlo method for calculation of nanoparticles' size distribution from the measured isothermal magnetization curves $M(H)$ above the blocking temperature where the nanoparticles are in a superparamagnetic regime.