MS28- Magnetic order: methods and properties

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MS28-P01

Phase transition of a spiral magnetic ordering in the Fe-based double-perovskite

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Using a modified traveling solvent floating zone technique, we are able to grow a high quality single crystal of the double perovskite oxide $YBaCuFeO_5$ for the detailed study using magnetization, dielectric constant, and neutron diffraction. We demonstrate that the crystal shows two antiferromagnetic transitions at T_{N1}~475 K and T_{N2}~175 K, and displays a giant dielectric constant with a characteristic of the dielectric relaxation at T_{N2}. It does not show the evidence of the electric polarization for the crystal. The transition at T_{N1} corresponds with a paramagnetic to antiferromagnetic transition with a magnetic propagation vector doubling the unit cell along three crystallographic axes. Such a paramagnetic state at high temperatures was also confirmed by the using inelastic neutron scattering. Upon cooling, at T_{N2}, the commensurate spin ordering transforms to a spiral magnetic structure with a propagation vector of (0.5*h* 0.5*k* 0.5*l*+-δ), where *h*, *k*, and *l* are odd, and the incommensurability is temperature dependent. Around the transition boundary at T_{N2}, both commensurate and incommensurate spin ordering coexist.

References:

[1] Yen-Chung Lai, et. al., J. of Phys.: Condensed Matter, 29, 145801 (2017).

Keywords: phase transition, spiral magnetic ordering, neutron scattering

MS28-P02

Neutron powder diffraction study of $Tm_2Mn_2O_7$ and $Y_2Mn_2O_7$ - pyrochlore obtained by yet another chemical route of synthesis

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The rare earth manganese (IV) pyrochlores cannot be synthesized at ambient pressure requiring high pressures for the stabilization of the pyrochlore lattice, which is mainly due to the small size of Mn (IV) compared to trivalent rare earth cations. All of these materials appear to be ferromagnets. Neutron studies of some selected $A_2Mn_2O_7$ (Y, Ho, Yb) were done, but still more work is needed to completely characterize their magnetic ground state. We present yet another chemical way of synthesis of $Tm_2Mn_2O_7$ [1] and $Y_2Mn_2O_7$ [2] pyrochlores and the studies of their magnetic and crystal structures by high resolution neutron powder diffraction. Both compounds are single phase pyrochlores ($Fd\bar{3}m$) at room temperature. On cooling below about 30K they show the transitions to the ferromagnetic state with additional antiferromagnetic (AF) canting on only one sort of atoms for $Tm_2Mn_2O_7$. The magnetic structure has magnetic Shubnikov group $I4_1/am'd'$ with the tetragonal distortion and large magnetostrsiction (especially for A=Y) refined from the diffraction data. The presence of AF canting in both compounds with magnetic (Tm) and nonmagnetic (Y) A-cation allows us to assign AF-ordering to Mn-sublattice.

References:

[1] E. Pomjakushina et al, (2015) Inorganic Chemistry, 54, 9092
[2] V. Pomjakushin et al, to be published

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