Magnetism in Kagome Antiferromagnet $MgMn_3(OH)_6Cl_2$

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Geometrically frustrated magnetism usually found in kagome, triangular, and pyrochlore lattice has received a lot of attention because of exotic ground states. Geometrical frustration leads to degeneracy, enhances spin fluctuations and suppresses magnetic long range ordering (LRO) [1-2]. Recently, spin liquid, partially frozen state with persistent spin fluctuation, and ordered state are found in $ZnCu_3(OH)_6Cl_2$ [3], $Co_3Mg(OH)_6Cl_2$ [4], and $MgFe_3(OH)_6Cl_2$ [5] kagome compounds, respectively. Beside spin-liquid state in low spin system, high spin classical or quasi-classical kagome antiferromagnets are of much interest. Here, we briefly describe the growth and magnetic characterization of S=5/2 kagome compound $MgMn_3(OH)_6Cl_2$. Polycrystalline $MgMn_3(OH)_6Cl_2$ compound was synthesized by solvothermal reaction of $MgCl_2$. $6H_2O$, $MnCl_2$. $4H_2O$ and NaOH in water-ethanol solution in N_2 atmosphere at high temperature. The compound was subject to x-ray diffraction (XRD), dc magnetic, and neutron powder diffraction experiments. The refined XRD data confirmed that the $MgMn_3(OH)_6Cl_2$ compound crystallizes in the rhombohedral structure with space group R-3*m*, with magnetic ions in the triangular planes almost completely replaced by non-magnetic Mg^{2+} shown in Fig. 1. The susceptibility measurement showed antiferromagnetic transition T_N at 7.9 K as presented in Fig. 2.

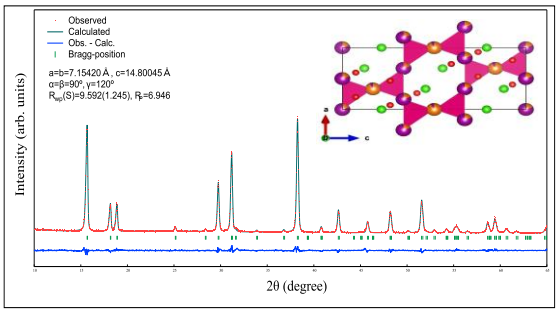

Fig.1: The Rietveld refinement of XRD pattern of $MgMn_3(OH)_6Cl_2$ compound.

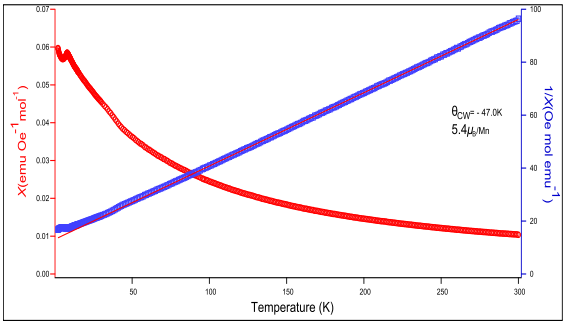

Fig. 2: Temperature dependence of the dc susceptibilities χ (left axis) and the inverse susceptibilities $1/\chi$ (right axis).

The experimentally estimated values of Curie-weiss temperature (θ_{CW}), curie constant (C), and effective magnetic moment (μ_{eff}) are -47 K. 3.61 emu K mol^{-1}, and 5.4 μ_B per Mn^{2+} spin. Neutron diffraction experiment confirm long-range antiferromagnetic order developed below 8 K in $MgMn_3(OD)_6Cl_2$ compound.

References

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