Studying the spin-liquid behaviour in $A_2RE_3Sb_3O_{14}$ and derivatives

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Kagome structures are structures exhibiting frustrated magnetism due to their triangular geometry. A three-dimensional analogue of the Kagome lattice is the pyrochlore lattice (represented as $A_2B_2O_7$) which is constructed from corner sharing tetrahedra. Pyrochlore lattices (space group Fd-3m) containing A and B type of cations (magnetic, non-magnetic ions) that are stacked alternatively as A:B and B:A layers [1]. By selective doping of nonmagnetic ions, two-dimensional Kagome lattice can be isolated from the pyrochlore lattice. In the Tripod Kagome Lattice (TKL) compound, spins remain entangled and do not order in the zero-temperature limit [2]. Therefore, the kagome compounds are potential candidates for quantum spin liquid.

We aim to scrutinize the structural and physical properties of $A_2R_3Sb_3O_{14}$ ($A = Mg,Zn,Co,Ca ; R = Ho,Pr$). The scope of the study includes magnetic and transport properties along with crystal structure and magnetic structure of these compounds. We have prepared Mg:Ho:Sb:O$_{14}$, Zn:Ho:Sb:O$_{14}$, Co:Ho:Sb:O$_{14}$, Ca:Pr:Sb:O$_{14}$ compounds by solid-state reaction method and the XRD study shows that the majority phase is Mg:Ho:Sb:O$_{14}$, (Mg-Ho) with some impurity phase. The neutron diffraction study confirms formation of Zn-Ho in single phase whereas Co-Ho and Ca-Pr are still under study. Magnetization study for Zn-Ho has been carried out by employing Physical Properties Measuring Systems (PPMS) with a magnetic field of 1000 Oe in the temperature range of 3K to 300K. No magnetic ordering was observed down to 3K. The temperature-dependent neutron diffraction by employing a powder neutron diffractometer (PD-3) is underway. Analysis of temperature-dependent neutron diffraction will lead us to understanding of magnetism involved. Through this systematic study, we also intend to explore the quantum spin liquid state in these compounds.

**Fig1**: Reitveld refinement profile for Zn:Ho:Sb:O$_{14}$

1. Zhao-Feng Ding, Yan-Xing Yang, Jian Zhang, Cheng Tan, Zi-Hao Zhu, Gang Chen, and Lei Shu