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Studying the spin-liquid behavior in Mg2Ho3Sb3O14 and derivatives

Kagome structures are triangular lattice structures exhibiting frustrated magnetism due to geometry. A three-dimensional analogue of the Kagome lattice is the pyrochlore lattice (represented as A2B2O7) which is constructed from corner sharing tetrahedra. Zhao-Feng Ding, et. al, have studied, Pyrochlore lattices (space group Fd-3m) containing A and B type of cations (magnetic, non-magnetic ions) that are stacked alternatively as A3B and B3A layers. By selective doping of nonmagnetic ions (e.g., Zn2+), two-dimensional Kagome lattice can be isolated from the pyrochlore lattice. Z. L. Dun, et. al also studied , in the Tripod Kagome Lattice (TKL) compound, spins remain entangled and do not order in the zero-temperature limit. Therefore, the kagome compounds are potential candidates for quantum spin liquid.

We aim to scrutinize the structural and physical properties of A2R3Sb3O14 (A = Mg,Zn,Co,Ca ; R = Ho,Pr,Y). The scope of the study includes magnetic and transport properties along with crystal structure and magnetic structure of these compounds. We have prepared Mg2Ho3Sb3O14, Zn2Ho3Sb3O14, Co2Ho3Sb3O14, Ca2Pr3Sb3O14 compounds by solid-state reaction method and the XRD study shows that the majority phase is Mg2Ho3Sb3O14,(Mg-Ho) with some impurity phase, 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.

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