Motivation: Non-centrosymmetric polar oxides are subjects of considerable interest due to varieties of important phenomena and associated functional properties. Magnetoelectric multiferroic oxides are one such system where the magnetic properties can be controlled by electric field or the electric properties can be controlled by the magnetic field [1]. This cross tunability magnetic and electrical properties makes multiferroic materials ideal candidates for making actuators, field sensors and memory devices. Simultaneous presence of broken inversion symmetry (electric polarization) and magnetism are two key requirements for multiferroicity. Non-centrosymmetric polar magnetic oxides simultaneously offer both (polarization and magnetization) properties. Therefore, we are working toward synthesis and investigation of non-centrosymmetric polar magnetic oxides of $RMWO_6$ (R= Rare earth, M= Cr, Fe) family.
Methodology: $RMWO_6$ are prepared in polycrystalline form by the high temperature (1000^0 C-1200^0 C) solid state reaction between R_2O_3 (R=rare earth), M_2O_3 (M=Fe,Cr) and WO_3 for several days and multiple intermediate grindings. The phase purity and the crystal structure are confirmed using laboratory x-ray diffractometer. The dielectric/ferroelectric properties are measured using LCR meter and ferroelectric tester. The magnetic properties are measured using SQUID magnetometer. The magnetic structure is measured using neutron diffraction.
Conclusions/expectations: We have successfully synthesized two members: $HoFeWO_6$ and $HoCrWO_6$ [2] and studied their structural, magnetic and dielectric properties. Our investigation indicates both are non-centrosymmetric antiferromagnets. The neutron diffraction measurements indicate that $HoCrWO_6$ has collinear antiferromagnetic structure [2] whereas $HoFeWO_6$ has non-collinear antiferromagnetic structure. The role of valence electrons on Fe and Cr, the role of crystal field splitting and the coupling between magnetic structure and ferroelectric polarization will be studied.