## Vacancy-Driven Magnetism of GdMnO<sub>3</sub>

Authors : Matúš Mihalik, Martin Vavra, Kornel Csach, Marián Mihalik

**Abstract** : GdMnO<sub>3</sub> belongs to orthorhombically distorted, GdFeO<sub>3</sub>-type family of perovskite compounds. These compounds are naturally vacant and the amount of vacancies depend on the sample preparation conditions. Our GdMnO<sub>3</sub> samples were prepared by float zone method and the vacancies were controlled using an air, Ar and O<sub>2</sub> preparation atmosphere. The highest amount of vacancies was found for sample prepared in Ar atmosphere, while the sample prepared in O<sub>2</sub> was observed to be almost vacancy-free. The magnetic measurements indicate that the preparation atmosphere has no impact on Néel temperature (TN ~ 42 K), however, it has strong impact on the incommensurate antiferromagnetic (IC) to canted A-type weak ferromagnetic (AWF) phase transition at T1: T1 = 23.4 K; 18 K and 6.7 K for samples prepared in Ar; air and O<sub>2</sub> atmosphere; respectively. The hysteresis loop measured at 2 K has a butterfly-type shape with the remnant magnetization (Mr) of 0.6 µB/f.u. for Ar and air sample, while Mr = 0.3 µB/f.u. for O<sub>2</sub> sample. The shape of the hysteresis loop depends on the preparation atmosphere in magnetic fields up to 1.5 T, but is independent for higher magnetic fields. The coercive field of less than 0.06 T and the maximum magnetic moment of 6 µB/f.u. at magnetic field µ0H = 7 T do not depend on the preparation atmosphere. All these findings indicate that only AWF phase of GdMnO<sub>3</sub> compound is directly affected by the vacancies in the system, while IC phase and the field induced ferroelectric phase are not affected.

1

Keywords : magnetism, perovskites, sample preparation, magnetic phase transition

Conference Title : ICM 2023 : International Conference on Magnetism

Conference Location : Montreal, Canada

Conference Dates : August 03-04, 2023