11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

Synthesis bulk material and Magnetic Properties of $Tb_{1-x}Al_xMnO_3$.

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Abstract: Bulk polycrystalline material $TbMnO_3$ was synthesized, pure and aluminum-doped: $Tb_{1-x}Al_xMnO_3$ (x=0, 0.05, 0.07, 0.1, 0.3) by solid state reaction from Tb_4O_7 (99.998%), MnO_2 (99.998%), Al_2O_3 (99.98%) oxides. Samples were syntherized at 1200℃ for 12 hours in air atmosphere. $Tb_{1-x}Al_xMnO_3$ structure was analyzed by X–ray diffractions analysis (XRD). Magnetic properties of $TbMnO_3$ and $Tb_{1-x}Al_xMnO_3$ were analyzed by both magnetic susceptibility as function of temperature $\chi(T)$ (Fig. 1) and magnetization as a function of magnetic field $M(H)$ (Fig. 2)measurements.

Multiferroics materials exhibit, in the same phase, 2 of 3 ferric properties; ferroelectricity, ferromagnetism and ferroelasticity [1] and a coupling between them. Multiferroics magnetoelectrics are both ferroelectrics and ferromagnetics, as a result they have a spontaneous electric polarization that can be switched by applying an electric field, and present a spontaneous magnetization that can be switched by applying a magnetic field [2]. In this work was synthesized bulk polycrystalline material $TbMnO_3$, pure and aluminum-doped: $Tb_{1-x}Al_xMnO_3$ (x=0, 0.05, 0.07, 0.1, 0.3) by solid state reaction from Tb_4O_7 (99.998%), MnO_2 (99.998%), Al_2O_3 (99.98%) oxides. Samples were syntherized at 1200℃ for 12 hours in air atmospher e. By X–ray diffractions analysis (XRD), for low concentrations of aluminium stand the $TbMnO_3$ structure, if the aluminum concentrations increasing we observed a distortion in Perovskite structure represented by a displacement of peaks in the XRD difractograms. Magnetic properties of $TbMnO_3$ and $Tb_{1-x}Al_xMnO_3$ were analyzed by both magnetic susceptibility as function of temperature $\chi(T)$ and magnetization as a function of magnetic field $M(H)$ measurements. Magnetic measurements show antiferromagnetic behavior in pure material samples and a weak ferromagnetism in the aluminum-doped material. The samples with x = 0.05 and 0.1 present a Curie temperature around 30K.

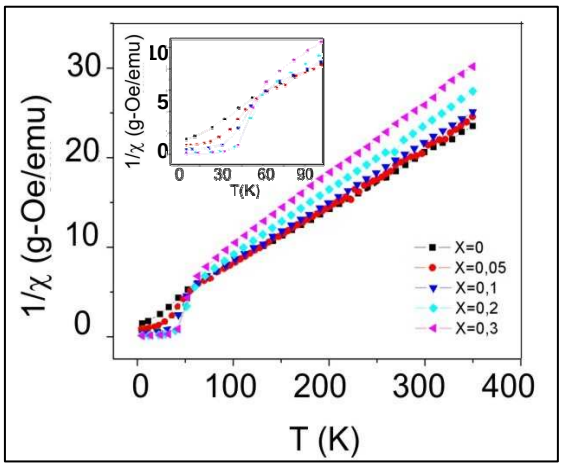

Figure 1. Inverse Susceptibility as function of temperature. Inset: Zoom, range of temperatures lower than 90K. Magnetic Field applied 200 Oe.

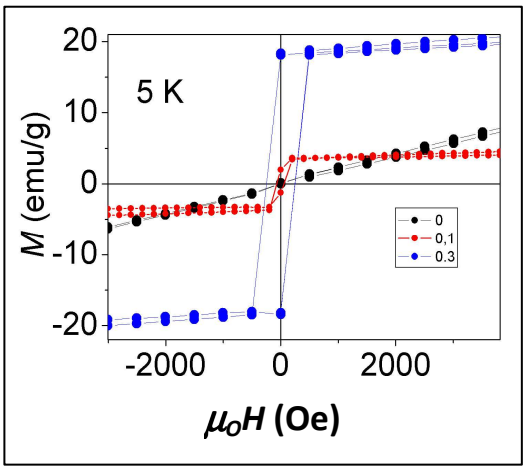

Figure 2. Measurements Magnetization as a function of magnetic field applied, for $TbMnO_3$ pure and doped X=0.1 and 0.3. Temperature of 5K.

References

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