Doped rare earth oxides are potential materials not only due to expected applications taking advantages of their properties, but also because of the interesting physics in this class of materials. The structure and magnetic properties of the two systems Er$_2$MnO$_3$ and Er$_2$NiO$_3$ have been investigated. The two systems with the composition $x=0.0, 0.05, 0.10$ and 0.15 were prepared with the sol gel technique. Single phase solid solution is formed up to $x=0.2$ for Er$_2$MnO$_3$, while for Er$_2$NiO$_3$ single phase is obtained only for $x=0.05$. All structural parameters including the cation distribution between the non-equivalent sites 8b and 24d have been determined applying Rietveld method. Inspite of the smaller ionic radii of Mn$^{+3}$ and Ni$^{+3}$ than that of Er$^{+3}$, substituting the later by one of the formers is found to increase the lattice parameter (a) of the cubic bixbyite structure. For the system Er$_{2-x}$Ni$_x$O$_3$, slight preferential distribution is found for $x=0.05$ & 0.15 with different preferred site, and random for $x=0.1$. Magnetic susceptibility measurements were done in the temperature range 5-300 K and a behavior in accordance with Curie-Weiss law was found. The Curie’s constants, the Curie-Weiss paramagnetic temperature and effective magnetic moments $\mu_{\text{eff}}$ were determined for all samples. For the system Er$_{2-x}$Ni$_x$O$_3$, $\mu_{\text{eff}}$ is found to decrease linearly with composition parameter $x$. For Er$_2$MnO$_3$, interesting behavior is obtained where $\mu_{\text{eff}}$ increases for $x<0.05$ and decreases for $x=0.1 & 0.15$ with a bigger value for the later. The Curie-Weiss paramagnetic temperatures indicated antiferromagnetic interaction. These magnetic results are discussed in view of the cationic distribution and magnetic ions clustering.

Keywords: Magnetic measurements, Cation distribution, rare earth sesquioxides


Gallium iron oxide (GaFeO$_3$) is a member of a multiferroic family which exhibits ferrimagnetic and piezoelectric properties below room temperature [1-2]. This material has orthorhombic crystal structure with space group P c 2$_{1}$ n with four different cation sites labeled Ga1, Ga2 (mostly occupied by gallium) and Fe1, Fe2 (mostly occupied by iron) [3-5]. Polycrystalline GaFeO$_3$ materials have been prepared by a traditional solid state reaction (SR) and sol-gel (SG) methods. The Curie temperature ($T_C$) for GaFeO$_3$ (SR) is about 190K and increases or reaches room temperature when the temperature of preparation is decreased from 1400°C to 900°C. The dielectric constant and dielectric loss are temperature and frequency independent for both samples. Mossbauer analysis shows that at least two different assignment of the EFG and IS for the main Fe1 and Fe2 sites are possible. Both assignments result in similar site occupancies. It follows from the neutron powder diffraction that GaFeO$_3$ exhibits a ferrimagnetic order with spins parallel to c-axis. Also Mossbauer indicates for higher temperature of magnetic order in SG sample, in agreement with magnetization and neutron data.

Keywords: Multiferroics, Mossbauer, Neutron diffraction.
and transforms to an anti-ferromagnetically ordered state (θ = -18.6(2) K) below 33 K. The magnetic spin structure can be described with k = (0, 0, 0) in space group Pnma and it is similar to the one of the C2/c phase except that it is non-collinear in nature, i.e. there are components of the magnetic moment along all three crystallographic axes. Small magnetoelastic coupling is observed in the orthorhombic phase. More details are reported in [5].


Keywords: pyroene, neutron diffraction, magnetism

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Magnetostuctural and magnetocaloric properties of Ni50-xCuxMn36Sn14 by magnetic measurements and neutron diffraction experiments. Ilker Dincer1, Yalcin Elerman1, Ercüment Yüzüka, Markus Hölzel2, Anatoliy Senyshyn3, Eyüp Duman4, Thorsten Krenke2,
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Compared with conventional refrigeration, magnetic refrigeration technology has many advantages, such as the absence of harmful gas, less noise, low cost and high efficiency. Since the discovery of martensitic transformation, martensite state may bring about magnetoelasticity (two-way magnetic field is removed. A complete recovery of the initial martensitic phase is observed when the magnetic field is increased or decreased. Martensite phase of these compounds transforms to Austenite phase with increasing the magnetic field from 0 to 5 T, while these compounds remains in the Austenite phase with decreasing the magnetic field to zero Tesla. This is the evidence of the irreversible magnetostructural transition occurred in these compounds. Because of that, the determination of the magnetic entropy change in alloys which show the irreversible magnetostructural transition has carefully been studied [2].


Keywords: Neutron diffractions, Magnetostuctural transition, Magnetocaloric effect

FA5-MS41-P05

Structural, magnetic and magnetocaloric effect in the off-stoichiometric Gd5Ge2.05-Si1.95-Mn2x alloys Yalcin Elerman1, Ercüment Yüzüka, Ilker Dincer
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Magnetic refrigeration based on MCE of solid-state working substances have attracted tremendous attention in recent years due to its energy efficient and environment friendly properties as compared with the gas compression refrigeration technology that is used currently. Practical applications of the MCE, therefore, have the potential to reduce the global energy consumption and eliminate or minimize the use of ozone-depleting alloys, greenhouse gases, and precarous. After the discovery of the giant magnetocaloric effect in the Gd5Si2Ge2 alloy, there has been much interest in the Gd5(Si1-xGe1-x)2 alloy family alloys [1]. As seen in earlier studies, the stoichiometric Gd5Si2Ge2 with doping alloys have not won with the appropriate of magnetocaloric features. For this reason, we attempt to improve the magnetocaloric properties of the off-stoichiometric Gd5Ge2.05Si1.95Mn2x alloy by replacing non-magnetic Ge/Si atoms by a small amount of magnetic Mn atom. We have investigated the structural, magnetic and magnetocaloric properties of the Gd5Ge2.05-Si1.95-Mn2x (2x=0.02, 0.06) alloys using scanning electron microscopy, x-ray powder diffraction, DSC and magnetic measurements. According to DSC and magnetic measurements, the both alloys exhibit a structural phase transition (the first order phase transition ) around room temperature. The Curie temperatures of these alloys are around 295 K. We determine the magnetic entropy changes near the transition temperatures using Maxwell relation and magnetization data. The maximum values of isothermal magnetic entropy change of the Gd5Ge2.05-Mn2x alloy with 2x = 0.02 that occurred is found to be -12.1 J/kg.K and -19.8 J/kg.K around 268 K in an applied field of 2 T and 5 T, respectively. The magnetic entropy changes are also estimated from DSC analysis for each alloy. The values of the magnetic entropy change of the Gd5Si2.05Ge1.95-Mn2x (2x=