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BS22

Phase Transition and Magnetic Transport Properties for Single Crystal of $(Ca_{0.42}Sr_{0.58})_3Ru_2O_7$

Qing Ji[1], Ming Fu[1], Jianjian Ge[1], Bin Qian[1,2], Zhe Qu[2], Z.Q. Mao[2], and X.S. Wu[1]
[1]National Lab Nanjing Microstructures, Key Lab of Solid State Microstructures, Department of Physics, Nanjing University, Nanjing 210093,China
[2]Physics Department, Tulane University, New Orleans, Louisiana 70118, USA

Double layered Ca doped ruthenates $(Ca_{1-x}Sr_x)_3Ru_2O_7$ ($A_3M_2O_7$-type structure with A=alkaline metal, and M=transition metal; CSRO) system contains abundant physics, which relates to its novel structural phase transition. Ionic decreasing in A-site may induce the compressing in RuO_6 Octahedron in CSRO. The distortion around RuO_6 octahedron plays the critical role on phase transiton. There are two types of distortions containing in RuO_6 octahedron. One is the rotation of oxygen atoms in RuO_2 plane (or ab plane in unit cell), which enhances the ferromagnetic coupling (FM) among Ru^{3+} with 42% Ca replacing for Sr in CSRO. Another one results from the movement of vertex oxygen atoms in RuO_6 octahedron (tilting along c axis), which makes the in-plane ferromagnetic ordering vary to antiferromagnetic ordering (AFM). Study on the subtle structural variations is necessary to understand the physical properties in CSRO. In the present, detailed structural variations are obtained from Rietveld refinements from the single crystal after grinding using the X-ray powder diffraction data. Two phases of $Sr_3Ru_2O_7$-type (Bbcb symmetry) and $Ca_3Ru_2O_7$-type ($Bb2_1m$) are observed in low temperature, which varying with temperature. The lattice constants dependence of temperature is calculated. The oxygen rotation in RuO_6 is about 18.8°, while the titling angle is also zero from the refinements. Magnetization measurements show that the magnetic moment along a-axis is the same as that along b-axis. At T~10 K, the DC M (T) shows an irreversibility behavior, while the AC suscibility χ (T) is frequency independent, which tells us there is no spin glass state at this temperature but the antiferromagnetic fluctuation still exists. The in-plane and out of plane resistivities dependence of temperature shows that ρ_c ̄ ρ_{ab}, and a kink relation in ρ_{ab}-T curve, which corresponds to the structural variations at low temperature.

BS23

Magnetocaloric Effects of Zn-Co Mixed Ferrites

Seung-Iel Park[1], Sung Wook Hyun[1], Jae Yun Park[2], and Chul Sung Kim[1]*
[1]Department of Physics, Kookmin University, Seoul 136-702, Korea
[2]Department of Materials Science and Engineering, University of Inchon, Inchon 402-749, Korea
*Corresponding author: Chul Sung Kim, e-mail: cskim@phys.kookmin.ac.kr

Many researchers have been studied to the magnetic refrigeration[1-3] used the metal based magnetic materials. Also the magnetic oxide based materials have actively studied. Polycrystalline samples of the $Zn_{1-x}Co_xFe_2O_4$ ($0.25 \leq x \leq 0.35$) were prepared with 1100°C sintering by a solid state reaction method. The x-ray diffraction patterns of Zn-Co mixed ferrites were indicated a cubic spinel structure at room temperature. As the Cobalt ion increased, the lattice constant a_0 is decreased from 8.435 to 8.431 Å, while the magnetic Néel temperature is increased. The magnetic Néel temperature is determined the dσ/dT curve for the zero field cooled curve under external field of 100 Oe. Figure 1 show the $Zn_{1-x}Co_xFe_2O_4$ ($0.25 \leq x \leq 0.35$) of the magnetic hysteresis curves at room temperature. As the Zn-Co mixed ferrites, the maximum magnetocaloric effects show around the utmost limits for the *dσ/dT* curve. We measured various temperature ranges of the magnetic hysteresis curves around the the utmost limits for the *dσ/dT* curve. The magnetocaloric effect for samples was calculated by used the numerical formula (1).[2]

$$\Delta S_m(T,\Delta S)=\int_0^H\left(\frac{\partial M}{\partial T}\right)_H dH \qquad (1)$$

ΔS_m is the magnetic entropy variation value.

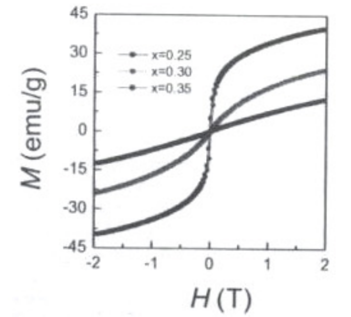

Fig. 1. The $Zn_{1-x}Co_xFe_2O_4$ ($0.25 \leq x \leq 0.35$) of the magnetic hysteresis curves at room temperature.

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