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ABSTRACTS

2T-34. PHASE TRANSITIONS IN $La_{1-x}Ce_xMnO_3$. Bo Wha Lee, Young Jun Kim, Kum Young Seo, Ho Haeng Lee (Hankuk University of Foriegn Studies, Physics, Yongin, Kyungki, 449-791, South Korea) and Chul Sung Kim (Kookmin University, Physics, Seoul, Kyungki, 136-702, South Korea)

Phase transitions in $La_{1-x}Ce_xMnO_3$ (x=0.2, 0.3, 0.4) were investigated by means of electrical resistivity, magnetization, specific heat, and photoacoustic signal measurements. The substitution of La by Ce in $LaMnO_3$ induces a metal- insulator transition accompanied by the occurrence of ferromagnetic ordering, similar to divalent ion doped compounds $La_{1-x}A_xMnO_3$ (A=Ca, Sr, Ba). The ferromagnetic transitions occur at 249K for x=0.2, 259K for x=0.3, and 249K for x=0.4. A sharp resistivity peak superimposed on a more rounded peak appears at a temperature higher than the ferromagnetic transition temperature. There is no observable thermal hysteresis in resistivity measurements, and the change of photoacoustic signal amplitude arises at the same temperature in both cases with decreasing and increasing temperatures. This implies that the phase transition can be regarded as a second-order phase transition with no latent heat at transition temperature.

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2T-35. ROLE OF INTERMEDIATE-LAYER FOR $La_{2/3}Sr_{1/3}MnO_3/SiO_2/Si(100)$ GRANULAR THIN FILMS. In-Bo Shim, Young-Jei Oh (Korea Institute of Science and Technology, Thin Films Technology Research Center, Seoul, 136-791, South Korea)

Although the perovskite $La_{2/3}Sr_{1/3}MnO_3$ thin films have been successfully grown on substrates such as $LaAlO_3$ and $SrTiO_3$ single crystal, growth and optimization of these films on technologically viable substrates are needed. Silicon wafer, the essential material of semiconductor industry, is one of such desirable substrates. In general, there is a problem of interface reaction between Si wafer and the deposited thin film layers that must be avoided. In this study, we have deposited LSMO (1500 Å)/YSZ (100-1500 Å)/Si (100) bilayers by sol-gel method. The AFM and FE-SEM for the thin films showed the peak-to-valley surface roughness, which was approximately 102 Å for $LSMO/SiO_2/Si$ and 80 Å for LSMO/YSZ/Si, respectively. Hysteresis loops for the films with and without YSZ buffer layer had similar coercivity (H_c) of 88 Oe. However, the magnetization (M_s) of the films with YSZ buffer layer (430 emu/cc) was higher than that without the buffer layer (320 emu/cc). In the case of the thin film without YSZ buffer layer, Si element was detected all across the LSMO layer, but better results are obtained in the LSMO/YSZ/Si thin films. In the cross-sectional TEM image of LSMO and SiO_2/Si interfaces, the dead layer with thickness 50 nm was observed by interface reaction during the later stage of the deposition. However, the interface between the YSZ and LSMO thin layers is free of any second phase or dead layer. In low-field magnetotransport measurement at room temperature, the MR ratio of the films with YSZ buffer layer (MR=0.43 %) was higher than that without the buffer layer (MR=0.21 %). The results show that the YSZ as diffusion barrier was attributed to the fine microstructure of LSMO thin films and the reduction of interface reaction between LSMO thin film and $SiO_2/Si(100)$ substrate.

2T-36. STRUCTURAL AND MAGNETIC PROPERTIES OF $La_{0.6}Sr_{0.4}MnO_3$ AND $La_{0.6}Sr_{0.4}FeO_3$ COMBINED SYSTEM. Chul Sung Kim, Young Rang Uhm (Kookmin University, Dept. of Physics, 861-1, Songbuk-ku, Seoul, 136-702, South Korea) and Sung Hyun Yoon (Kunsan National University, Dept. of Physics, 68, Kunsan, Chunbuk, 573-702, South Korea)

The composed of ferromagnetic metal of $La_{0.6}Sr_{0.4}MnO_3$(LSMO) and antiferromagnetic insulator of $La_{0.6}Sr_{0.4}FeO_3$(LSFO) thin film on SiO_2 and the powder were fabricated to obtain a low field magnetoresistance by a sol-gel method. Their structure and magnetic properties were investigated by X-ray diffractometer(XRD), SQUID magnetometer, and Mössbauer spectroscopy. A mixture of powder was annealed at 800°C. The XRD pattern of powder and thin films indicate no evidence of reaction between the $La_{0.6}Sr_{0.4}MnO_3$ and $La_{0.6}Sr_{0.4}FeO_3$. The microstructure of LSMO / LSFO / SiO_2/Si(100) film consisted of 20-60 Å in surface roughness(rms). With increasing of LSFO, T_C and magnetization at low temperature are lower. Weakening of ferromagnetism also makes resistivity higher and insulating. The magnetization of the combined different-grain-sized sample(with 30 wt % LSFO) is smaller (17 emu/g)than that of same-grain-sized LSMO(27 emu/g) at 5 K in the field of 500 Oe.

2T-37. MAGNETIZATION ANOMALY ASSOCIATED WITH POLARON ORDER IN $La_{1-x}Ca_xMnO_3$ (x∼1/8). Hiroyuki Fujishiro, Manabu Ikebe (Faculty of Engineering, Iwate Univ., 4-3-5 Ueda, Morioka, 020-8551, Japan) and Tetsuo Fukase, Atsushi Sakamoto (Institute for Materials Research, Tohoku Univ., 2-1-1 Katahira, Sendai, 980-8577, Japan)

The magnetization M(T) of ferromagnetic $La_{1-x}Ca_xMnO_3$ (LCMO) was measured and an anomalous reduction of M(T) under low applied fields was observed at a characteristic temperature TM (TM<Tc). The M(T) anomaly at TM occurs for X<0.18 where LCMO samples show an insulating behavior of the resistivity. In a previous paper, we reported the sound velocity (Vs) anomaly at T* (T*<Tc) caused by the polaron ordering in just the same Ca concentration range, X<0.18.1) The distribution of the polaron ordering temperature T* was centered at X=1/8, showing a maximum at this concentration. Although TM is about 40∼50K lower than T*, the distribution of TM is also centered at X=1/8 and the M(T) anomaly at TM is possibly to be related to the polaron ordering in some way. The width of La NMR absorption was found also to show an anomaly at around TM. The similar anomaly of M(T) was confirmed also in $La_{1-X}Sr_XMnO_3$ whose Vs shows the X=1/8 anomaly.2) The low field magnetization anomaly found in this study is likely to be a common feature in the polaron ordered systems.

[1] H. Fujishiro, T. Fukase, M. Ikebe and T. Kikuchi: J. Phys. Soc. Jpn. 68 (1999) 1469.

[2] H. Fujishiro, M. Ikebe, Y. Konno and T. Fukase: J. Phys. Soc. Jpn. 66 (1997) 3703.

2T-38. ABSENCE OF ANTIFERROMAGNETIC METALLIC STATE IN SINTERED $La_{1-Z}Nd_Z)_{1-X}$SrXMnO$_3$. Manabu Ikebe, Hiroyuki Fujishiro, Hideyuki Ozawa, Akihiro Sugawara (Faculty of Engineering, Iwate Univ., 4-3-5 Ueda, Morioka, 020-8551, Japan)

In $(La_{1-Z}Nd_Z)_{1-X}SrXMnO_3$ at X∼0.5, the ferromagnetic order in a high temperature region becomes unstable with decreasing temperature and the the A-type antiferromagnetic order appears at a low temperature. Akimoto et al. reported an antiferromagnetic metallic state for this system.1) On the other hand, the present authors observed for sintered $La_{0.50}Sr_{0.50}MnO_3$ a ferromagnetic to antiferromagnetic (A-type) transition with clear insulating r(T) behavior below TN.2) In the present paper, the magnetic and the electrical properties of sintered $(La_{1-Z}Nd_Z)_{1-X}SrXMnO_3$ (0.48<X<0.55 and 0<Z<1.0) samples were investigated. r(T) of all the antiferromagnetic samples showed insulating behavior below TN and no antiferromagnetic metallic state was confirmed. For single crystals grown by a floating-zone (FZ) method, we observed the antiferromagnetic metallic state in accord with the results of Akimoto et al. The qualitative difference in the r(T) behavior cannot be explained by only the enhanced electron scattering in the sintered samples. The inevitable local fluctuation of the concentration X in FZ samples may mask out the intrinsic insulating behavior of the A-type antiferromagnetic state in this system, though the ferromagnetic layers in the A-type structure permit pretty free electron conduction in comparison to other type antiferromagnetic structures.

[1] T. Akimoto et al., Phys. Rev. B57 (1998) 57.

[2] H. Fujishiro, M. Ikebe and Y. Konno: J. Phys. Soc. Jpn. 67 (1998) 1799.

2T-40. $LaMn_{1-x}Sn_xO_y$: DEPRESSION OF THE MAGNETIZATION. Liliana Morales, Alberto Caneiro, Rodolfo D. Sánchez (Comisión Nacional de Energía Atómica, Centro Atómico Bariloche, Av. Bustillo 9500, Bariloche, RN, 8400, Argentina) and Daniel Vega (Comisión Nacional de Energía Atómica, Centro Atómico Constituyentes, Av. Gral. Paz 1499, Buenos Aires, Buenos Aires, 1650, Argentina)

After the discovery of the colossal magnetoresistance in manganese perovskites (ABO_3), a renewed interest exists on the study of the structural,