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ABSTRACTS

thickness t increases. As the temperature decreases, the dip in GMR profile disappears, meaning that implantation effect becomes negligible irrespective of pinned layer thickness. As a whole, the MR ratio increases with decreasing temperature. The GMR profiles show the sharp increase of resistivity near zero magnetic field in spin-valve type at low temperature of 50 K. The GMR profiles were analyzed by using the double domain model [1] to give a good fitting with the measured profiles. The fitting results indicate that the N-ion implantation does not affect on the magnetic characteristics in free layer, but causes the significant change of intrinsic magnetic properties of anisotropy constant and exchange coupling field in pinned layer.

[1] D.Y. Kim, C.G. Kim, B.S.Park, D.G. Hwang and S.S. Lee, IEEE Trans. Magn. 35, 2934 (1999).

4T-24. CORRELATIONS BETWEEN SPIN ORIENTATION, STRUCTURAL DISTORTIONS, AND CONDUCTIVITY FOR MANGANITES. B. Dabrowski, X. Xiong, Z. Bukowski, O. Chmaissem, J. Mais, C.W. Kimball (Argonne National Laboratory, Materials Science Division, 9700 S. Cass Ave., Argonne, IL, 60439, US) and J.D. Jorgensen, S. Short (Argonne National Laboratory, Materials Science Division, 223, 9700 S. Cass Ave., Argonne, IL, 60439, US)

Magnetic interactions in Perovskite manganites are described in terms of the interplay between super- and double-exchange that leads to competition between antiferromagnetic-insulating and ferromagnetic-metallic ground states. Colossal magnetoresistive effect (CMR) observed near the Curie temperature, Tc, have been recently shown to arise, in addition to magnetic interactions, from strong electron-phonon couplings of the Jahn-Teller (JT) or "breathing-mode" (CO) types. These interactions produce local structural distortions and cause charge localization. Strong coupling between magnetic and electron-phonon interactions, proximity of several structural transitions, and tendency to form defects result in a very rich structure-property relationships for $La_{1-x}A_xMnO_{3+d}$ (A = Ca, Sr, Ba) materials. We have performed comprehensive study of the synthesis conditions and have determined intrinsic phase-diagrams for stoichiometric compounds as a function of temperature and composition. For lightly substituted $La_{1-x}Sr_xMnO_3$ materials above Tc the crystallographic structure is orthorhombic (O'), characterized by coherent JT-orbital ordering of the long, = 2.1, and short, = 1.9 Å, Mn-O bonds. For x * 0.12, an orthorhombic phase (O*) is observed with considerably smaller coherent JT-orbital ordering and increased incoherent distortions. At higher Sr substitution level, $x > 0.17$, the structure is rhombohedral (R) with no coherent and large incoherent JT-orbital ordering. For $La_{1-x}Ca_xMnO_3$ the O'/O* transition at room temperature appears near x = 0.15. Upon substitution, the canted antiferromagnetic insulator transforms to a ferromagnetic insulator and to a ferromagnetic metal. Lowering temperatures below the ferromagnetic transition results in distinct modifications of the structural phases and concurrent changes of the physical properties. Development of the ferromagnetic order suppresses coherent JT-distortions for the O' phase and incoherent distortions for the O* and R phases. The orientation of the ferromagnetic spin moments is mainly pointing along the b axis when coherent JT-distortion is large and aligns almost along the c axis as coherent JT-distortion diminishes. As a result the metallic state occurs below the Curie temperature only when both coherent and incoherent JT-distortions are suppressed and the ferromagnetic spin moments are oriented along the c axis. The insulating phase is formed above T_c due to enhanced spin scattering in the paramagnetic state and polaronic JT-distortions that induce charge localization. Knowledge of the phase-diagrams has been used to design compounds with improved low-field CMR effect at room temperature.

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4T-26. ROOM TEMPERATURE MAGNETORESISTANCE IN Ba_2FeMoO_6. J. S. Park, Y. J. Kim, J. Y. Kim, B. J. Han, B. W. Lee (Hankuk University of Foreign Studies, Physics, Yongin, Kyungki, 449-791, South Korea)

Room temperature magnetoresistance effect has been observed for polycrystalline double perovskite Ba_2FeMoO_6, which has been prepared by solid-state reaction in a stream of 5% H_2/Ar. The temperature dependence of resistivity shows metallic behavior below the ferromagnetic transition temperature of 312K. The magnitude of negative magnetoresistance with the magnetic field of 0.8T at 12 and 300K is as large as 27 and 5%, respectively. The observed magnetoresistance features do not show any hysteresis behavior related with ferromagnetic properties.

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4T-27. MAGNETIC ORDERING AND MAGNETORESISTANCE OF LAYERED PEROVSKITE $Nd_{1+x}Sr_{2-x}Mn_2O_7$. Masayuki Tsukamoto, Kiyotaka Miyoshi, Kenji Fujiwara, Jun Takeuchi (Shimane University, Department of Material Science, 1060 Nishikawatsu, Matsue, Shimane, 690-8504, Japan)

Magnetic and transport properties of Layered Perovskite $Nd_{1+x}Sr_{2-x}Mn_2O_7$ crystals grown by the floating zone method have been studied. The material with x=0 is insulating and antiferromagnetic with spin-glass-like behavior at low temperature. On increasing x, the antiferromagnetic behavior is suppressed and ferromagnetic behavior appears, and the resistivity decreases. The material with x=0.4 has a resistivity maximum showing a metal-insulator transition near the ferromagnetic transition temperature. The magnetic field of 7T causes the negative magnetoresistance of 54% there. The material x=0.2 is interesting because it shows successive magnetic transitions at T_{c1}=240 K and T_{c2}=100 K. The magnetization starts to increase gradually below T_{c1}, probably due to a two dimensional ferromagnetic alignment. The magnetization decreases having a maximum around T_{c2} under an applied magnetic field of 0.01T and that increases having a shoulder around T_{c2} under 0.1T, both of which have a large deference between under zero-field-cooled and field-cooled conditions. Glass-like behavior below T_{c2} has been well confirmed by the linear and nonlinear AC susceptibility measurements. The resistivity increases steeply below T_{c2} and the magnetic field of 7T causes the colossal magnetoresistance of 97.5% there. These results are ascribed to the frustration of random competing double-exchange ferromagnetic and super-exchange antiferromagnetic interactions with the anisotropy originating from layered structure.

4T-28. STRESS-INDUCED ENHANCEMENT OF MAGNETORESISTANCE IN $La_{0.75}Ca_{0.25}MnO_3$ THIN FILMS GROWN ON SI(100) SUBSTRATES. Jong Cheol Lee, Dong Gyun You, Sang Yub Ie, Kwang Ho Jeong (Yonsei University, Department of Physics, 134 Shinchon-dong Seodaemu-gu, Seoul, 120-749, South Korea) and Sam Jin Kim, Chul Sung Kim (Kookmin University, Department of Physics, 861-1 Chongnung-dong Songbuk-ku, Seoul, 136-702, South Korea)

The enhancement of magnetoresistance (MR) in $La_{0.75}Ca_{0.25}MnO_3$ perovskite thin films, grown on Si (100) substrates by RF magnetron sputtering, was studied. All of as-deposited films were annealed at 800°C for 30min in air. Structures, magnetic properties and compositions of La-Ca-Mn-O films have been studied with X-ray diffraction (XRD), Rutherford back-scattering spectroscopy (RBS), X-ray photoemission spectroscopy (XPS), vibrating sample magnetometer and SQUID magnetometer. The films were polycrystalline with (100) and (110) orientations. The lattice constants of films were reduced as much as 0.9% compared to the one of the sputtering target, which proves that the compressive stress on films was imposed by Si substrate. It is found that the MR ratios ($\frac{\Delta\rho}{\rho_0}$) of films are 0.33, 0.29 and 0.27 under a magnetic field of 1.5T for each films with deposition temperatures of 700°C, 750°C and 800°C, respectively. The correlation between the MR ratios and lattice constants of films is investigated. As the lattice constants of films were decreased, the MR ratios of films were monotonically increased. It is concluded that the compressive stress on films cause the enhancement of MR ratios of thin films grown on Si (100) substrates.

4T-29. MAGNETORESISTANCE OF $La_{1-x}Sr_xMnO_3$ (x=0.19, 0.24, 0.27) FILMS BY RF MAGNETRON SPUTTER. Young Suk Cho, Jin Seok Hwang-Bo, Yeon Hee Kim, Sang Won Lee, Seung-Iel Park, Chul Sung Kim (Kookmin University, Department of Physics, Seoul, 136-702, South Korea)

La-Sr-Mn-O thin-films have been grown on SiO_2/Si(100) and MgO(100) substrate under rf power of 2.46 W/cm^2 at 700 °C by co-sputtered of