Growth and Transport Properties of Nd-Sr-Mn-O Thin Films

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ABSTRACT

Nd0.47Sr0.53MnO3 films were grown by using radio-frequency magnetron sputtering for studying their physic properties with different substrates, growth temperature and pressures. The crystal structure and lattice strain in films were analyzed with the powder X-ray diffractiometer. It is found that the strain in films increases with an increase of growth temperature and the thermal activation energy Eρ decreases with an increase of pressures. It is also found that the strain and resistivity decrease after the oxygen annealing. On the other hand, Nd0.7Sr0. 3MnO3 films were grown on SrTiO3(001) substrates for studying the variations of magnetoresistance (MR), metal-insulator transition temperature (Tp), temperature coefficient of resistance (TCR) and thermal activation energy Eρ under different magnetic fields. It is found that the maximum MR is 2669 % at H=7 T, and the maximum TCR value is 10.6 %K-1 at H=0 T for Nd0.7Sr0. 3MnO3 films. It has also been observed that the Eρ decreases with an increase of magnetic field.

Keywords : RF sputter ; metal-insulator transition temperature ; temperature coefficient of restistance ; magnetoresistance ; thermal activation energy

Table of Contents

REFERENCES

[1]H. J. Lee, J. H. Jung, J. S. Lee, and T. W. Noh, Phys. Rev. B 60, 5251 (1999).

[2]S. Valencia, Li Balcells, J. Fontcuberta, and B.Martinez, Appl. Phys. Lett. 82, 4531 (2003).
[3]F. Rivadulla, L. E. Hueso, D. R. Miguens, J. Appl. Phys. 91, 7412 (2006).
[4]Michael Ziese and Chatchai, Phys. Rev. B 58, 11519 (1998).
[5]Yu Lu, X. W. Li, G. Q. Gong, Gang Xiao, A. Gupta, P. Lecoeur, J. Z. Sun, Y. Y. Wang, and V. P. Dravid, Phys. Rev. B 54, R8357 (1996). J. S. Noh, T. K. Nath, C. B. Eom, J. Z. Sun, W. Tian, and X. Q. Pan, Appl. Phys. Lett. 79, 233 (2001).
[6]Alvydas Lisauskas, S. I. Khartsev, and Alex Grishin, Appl. Phys. Lett. 77, 756 (2000). Fan Yang, Laurence Mechin, Jean-Marc Routoure, Bruno Guillet, and Radoslav A. Chakalov, J. Appl. Phys. 99, 024903 (2006).
[7]C. Zener,Phys. Rev. 82 403 (1951).
[8]H.Y.Hwang, S-W. Cheong, P. G. Radaelli, M. Marezio, and B. Batlogg, Phys. Rev. Lett. 75, 914 (1995).
[9]S. Y. Wu, W. -H. Li, K. C. Lee, T. H. Meen, and H. D. Yang, 79, p6571-6573 (1996).
[10]W. -H. Li, Y. F. Lin, S. Y. Wu, K. C. Lee, J. W. Lynn, and H. C. Ku J. Appl. Phys. 79 , p6568-6570 (1996).
[11]W. -H. Li, W. Y. Chuang, S. Y. Wu, and K. C. Lee Japan Joint Seminar on Crystallograhpy p65-76 (1996).
[12]W. -H. Li, S. Y. Wu, K. C. Lee, J. W. Lynn, R. S. Liu, J. B. Wu, and C. Y. Huang, J. Appl. Phys. 85, p5588-5590 (1999).
[13]K. Ebata, M. Takizawa, K. Maekawa, A. Fujimori, H. Kuwahara, Y. Tomioka, and Y.Tokura, Phys. Rev. B 77, 094422 (2008).
[14]Y. M. Xiong, G. Y. Wang, X. G. Luo and C. H. Wang, J. Appl. Phys. 97, 083909 (2005).
[15]A. Barman and G. Koren, Appl. Phys. Lett. 77, 1674 (2000).
[16]X. J.Chen, H,-U. Habermeier, H.Zhang, G. Gu, M.Varela, and C. C. Almasan, Phys. Rev. B 72, 104403 (2005).
[17]M. Bibes, S. Valencia, Li. Balcells and B.Martinez, Phys. Rev. B 66, 134416 (2002).
[18]K. Chahara, T. Ohno, M. Kasai, and Y. Kozono, Appl. Phys. Lett. 63, 1990 (1993).
[19]R. von Helmlot, J. Weckerg, B. Holzapfel, L. Schultz, and K. Samwer, Phys. Rev. Lett. 71, 2331 (1993).
[20]S. Jin, T. H. Tiefel, M. McCormack, R. A. Fastnacht, R. Ramesh, and L. H. Chen, Science 264, 413 (1994).
[21]R. Shreekala, M. Rajeswari, S. P. Pai, S. E. Lofland, V. Smolyaninova, K. Ghosh, S. B. Ogale, S. M. Bhagat, M. J. Downes, R. L. Greene, R. Ramesh, and T. Venkatesan, Appl. Phys. Lett. 74, 2857 (1999).
[22]Chen, A. Goyal, M. Rajeswari, C. Kwon, R. Ramesh, T, Venlatesan, R. Shreekala, S. E. Lofland, S. M. Bhagat, Appl. Phys. Lett. 71, 2535 (1997).
[23]A. Barman and G. Koren, Appl. Phys. Lett. 77, 1674 (2000).
[24]Alvydas Lisauskas, S. I. Khartsev, and Alex Grishin , Appl. Phys. Lett. 77, 756 (2000).
[25]Fan. Yang, Laurence. Mechin, Jean-Marc. Routoure and Bruno. Guillee, J. Appl. Phys. 91, 7412 (2002).
[26]Tong Li, Bo Wang, Hongyun Dai, Yongsheng Du, and Hui Yan, J. Appl. Phys. 98, 123505 (2002).
[27]W. Prellier, M. Rajeswaari, T. Venkatesan, and R. L. Greene, Appl. Phys. Lett. 75, 1446 (1999).
[28]A. Goyal, M. Rajeswari, R. Shreekala, S. E. Lofland, S. M. Bhagat, T. Boettcher,C. Kwon, R. Ramesh, and T. Venkatesan, Appl. Phys. Lett. 71, 27 (1997).
[29]Soshin Chikazumi,Physics of Ferromagnetism (Whiley,New York, 1964) p.3.
[30]B.D.Cullity,IntroductiontoMagneticMaterials(Addison-Wesley,Massachusetts,1972) p.85.
[31]Robert C. O， Handley,Modern Magnetic Materials Principles and Applications (John Wiley and Sons,New York,2000).
[32]M. Julliere, Phys. Lett. 54A, 225 (1975).
[33]A. S. and A. M. Bratkvsky, Phys. Rev. Lett. 82, 141 (1999).
[34]Guo-meng Zhao, V. Smolyaninova, W. Prellier, and H. Keller,Phys. Rev. Lett. 84 6086 (2000).
[35]L. M. Wang, H. C. Yang, and H. E. Horng, ” Electrical transport and carrier density collapse in doped manganite thin films ” , Physical Review B 64, 224423 (2001).
[36]G. J. Snyder, R. Hiskes, S. DiCarolis, M. R. Beasley, and T. H. Ge, Phys. Rev. B 53, 14 434 (1996).
[37]T. Akimoto, Y. Moritomo, and A. Nakamura, Phys. Rev. Lett. 85, 3914 (2000).