Large magnetic entropy change above 300 K in a colossal magnetoresistive material $La_{0.7}Sr_{0.3}Mn_{0.98}Ni_{0.02}O_3$

Phan M.-H., Tho N.D., Chau N., Yu S.-C., Kurisu M.

Department of Aerospace Engineering, Queen's Building, University Walk, Bristol, BS8 1TR, United Kingdom; Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam; Department of Physics, Chungbuk National University, Cheongju 361-763, South Korea; School of Materials Science, Japan Advanced Institute of Science and Technology, Tatsunokuchi, Ishikawa 923-1292, Japan

Abstract: A thorough study of the magnetocaloric effect (MCE) in a colossal magnetoresistive compound of La0.7 Sr0.3 Mn0.98 Ni0.02 O3 has been made. The large magnetic entropy change of 7.65 Jkg K upon an applied field of 70 kOe has been found to occur at 350 K, which allows magnetic refrigeration at room temperature. It is interesting to note that, even in high magnetic fields, the magnetic entropy change versus temperature distribution is much more uniform than that of gadolinium and several polycrystalline perovskite manganites, which is desirable for an Ericson-cycle magnetic refrigerator. It is found that such a small amount (~2%) of substitution of Mn3+ by a magnetic ion (Ni3+ or Co3+) in the perovskite manganite can favor the spin order and hence the MCE. Undoubtedly, this observation opens a window to explore the active magnetic refrigeration at high temperatures. ?? 2005 American Institute of Physics.

Index Keywords: Energy dispersive spectroscopy; Entropy; Gadolinium; High temperature effects; Lanthanum compounds; Lattice constants; Magnetization; Microstructure; Perovskite; Polycrystalline materials; Scanning electron microscopy; SQUIDs; Thermal expansion; X ray diffraction analysis; Magnetic entropy changes; Magnetic refrigeration; Magnetocaloric effects (MCE); Room temperature; Colossal magnetoresistance

Year: 2005
Source title: Journal of Applied Physics
Volume: 97
Issue: 10
Art. No.: 103901
Page : 1-5
Cited by: 5
Link: Scorpus Link
Correspondence Address: Phan, M.-H.; Department of Aerospace Engineering, Queen's Building, University Walk, Bristol, BS8 1TR, United Kingdom; email: M.H.Phan@bristol.ac.uk
ISSN: 218979
CODEN: JAPIA
DOI: 10.1063/1.1895472
Language of Original Document: English

Abbreviated Source Title: Journal of Applied Physics
Document Type: Article
Source: Scopus
Authors with affiliations:

1. Phan, M.-H., Department of Aerospace Engineering, Queen's Building, University Walk, Bristol, BS8 1TR, United Kingdom
2. Tho, N.D., Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
3. Chau, N., Center for Materials Science, National University of Hanoi, 334 Nguyen Trai, Hanoi, Viet Nam
4. Yu, S.-C., Department of Physics, Chungbuk National University, Cheongju 361-763, South Korea
5. Kurisu, M., School of Materials Science, Japan Advanced Institute of Science and Technology, Tatsunokuchi, Ishikawa 923-1292, Japan

References:

1. Pecharsky, V.K., Gschneidner Jr., K.A., (1999) J. Magn. Magn. Mater., 200, p. 44
2. Phan, M.H., Yu, S.C., Handbook of Semiconductor Nanostructures and Nanodevices, , American Scientific, California, in press
3. Goodenough, J.B., (1955) Phys. Rev., 100, p. 564
4. Dan'kov, S.Yu., Tishin, A.M., Pecharsky, V.K., Gschneidner Jr., K.A., (1998) Phys. Rev. B, 57, p. 3478
5. Pecharsky, V.K., Gschneidner Jr., K.A., (1997) Phys. Rev. Lett., 78, p. 4494
6. (2000) Annu. Rev. Mater. Sci., 30, p. 387
7. Wada, H., Tanabe, Y., (2001) Appl. Phys. Lett., 79, p. 3302
8. Tegus, O., Bruck, E., Zhang, L., Dagula, Buschow, K.H.J., De Boer, F.R., (2002) Physica B, 319, p. 174
9. Guo, Z.B., Du, Y.W., Zhu, J.S., Huang, H., Ding, W.P., Feng, D., (1997) Appl. Phys. Lett., 78, p. 1142
10. Guo, Z.B., Yang, W., Shen, Y.T., Du, Y.W., (1998) Solid State Commun., 105, p. 89
11. Sun, Y., Tong, W., Zhang, Y.H., (2001) J. Magn. Magn. Mater., 232, p. 205
12. Wang, Z.M., Ni, G., Xu, Q.Y., Sang, H., Du, Y.W., (2001) J. Magn. Magn. Mater., 234, p. 371
13. Szewczyk, A., Szymczak, H., Wisniewski, A., Piotrowski, K., Kartaszynski, R., Dabrowski, B., Kolesnik, S., Bukowski, Z., (2000) Appl. Phys. Lett., 77, p. 1026
14. Phan, M.H., Tian, S.B., Yu, S.C., Ulyanov, A.N., (2003) J. Magn. Magn. Mater., 256, p. 306
15. Phan, M.H., Phan, T.L., Yu, S.C., Tho, N.D., Chau, N., (2004) Phys. Status Solidi B, 241, p. 1744
16. Phan, M.H., Yu, S.C., Hur, N.H., Jeong, Y.H., (2004) J. Appl. Phys., 96, p. 1154
17. Phan, M.H., Peng, H.X., Yu, S.C., J. Appl. Phys.
18. Bohigas, X., Tejada, J., Del Barco, E., Zhang, X.X., Sales, M., (1998) Appl. Phys. Lett., 73, p. 390
19. Phan, M.H., Srinivas, V., Yu, S.C., Hur, N.H., (2003) J. Appl. Phys., 93, p. 8200
20. Young, S.L., Chen, Y.C., Chen, H.Z., Horng, L., Hsueh, J.F., (2002) J. Appl. Phys., 91, p. 8915
21. Banerjee, S.K., (1964) Phys. Lett., 12, p. 16
22. Pecharsky, V.K., Gschneidner Jr., K.A., (2001) J. Appl. Phys., 90, p. 4614