

Large magnetocaloric effect around room temperature in $\text{La}_{0.7}\text{Ca}_{0.3-x}\text{Pb}_x\text{MnO}_3$ perovskites

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Abstract: Among perovskite manganites, a series $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3$ has the largest magnetocaloric effect (MCE) ($|\Delta S_m|_{\max} = 3.2\text{--}6.7 \text{ J/kg K}$ in $\Delta H = 1.35 \text{ T}$) but their Curie temperatures, T_C , are quite low (165–270 K). A system $\text{La}_{1-x}\text{Pb}_x\text{MnO}_3$ has quite high T_C (235–360 K) but exhibits not so large MCE (0.65–1.53 J/kg K). The manganites $\text{La}_{0.7}\text{Ca}_{0.3-x}\text{Pb}_x\text{MnO}_3$ ($x = 0.05, 0.10, 0.15$, and 0.20) have been fabricated by solid-state reaction technique with the expectation that they could establish large MCE at room temperature region. The prepared samples are of single phase with orthorhombic structure. Lattice parameters as well as volume of unit cell are continuously increased with increasing x due to large Pb^{2+} ions substituted for smaller Ca^{2+} ions. There is spin-glass (or cluster glass)-like state occurring in studied samples. T_C increases continuously from 270 K (for $x = 0.05$) to 338 K (for $x = 0.20$). Large MCE has been obtained in all samples and $|\Delta S_m|_{\max}$ reached the highest value of 3.72 J/kg K (with magnetic field variation $\Delta H = 1.35 \text{ T}$) for the sample $x = 0.05$ and the studied samples could be considered as giant magnetocaloric materials working for magnetic refrigeration. The magnetoresistance of samples exhibited colossal value. © 2006 Elsevier B.V. All rights reserved.

Author Keywords: Magnetic oxides; Magnetocaloric effect; Perovskite structure; Spin-glass behavior

Index Keywords: Curie temperature; Lattice constants; Magnetic fields; Magnetoresistance; Solid state reactions; Spin glass; Magnetic oxides; Magnetocaloric effect (MCE); Perovskite structures; Spin glass behavior; Perovskite

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References:

1. Hwang, H.Y., Cheong, S.-W., Radaelli, P.G., Marezio, M., Batlogg, B., (1995) Phys. Rev. Lett., 75, p. 914
2. Radaelli, P.G., Cox, D.E., Marezio, M., Cheong, S.-W., Schiffer, P.E., Ramirez, A.P., (1995) Phys. Rev. Lett., 75, p. 4488
3. Chau, N., Hanh, D.T., Tho, N.D., Luong, N.H., (2006) J. Magn. Magn. Mater., 303, pp. e335
4. Chau, N., Nhat, H.N., Luong, N.H., Minh, D.L., Tho, N.D., Chau, N.N., (2003) Physica B, 327, p. 270
5. Wang, T.S., Chen, C.H., Tai, M.F., (2001) Mater. Res. Soc. Symp. Proc., 674, pp. U341
6. Gschneidner, K.A., Pecharsky, V.K., (2000) Annu. Rev. Mater. Sci., 30, p. 387
7. Guo, Z.B., Du, Y.W., Zhu, J.S., Huang, H., Ding, W.P., Feng, D., (1997) Phys. Rev. Lett., 78, p. 1142

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