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Magnetocaloric effect for $Mn_{1-x}Fe_xAs$

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The structure and magnetocaloric effect of single phased $Mn_{0.997}{}^{57}Fe_{0.003}As$ were studied with x-ray diffraction, and vibrating sample magnetometer. In the $Mn_{0.997}{}^{57}Fe_{0.003}As$ sample, the first order ferromagnetic to paramagnetic transition was observed near at T_c 308 K when the sample was quenched, while T_c was around 314 K, when it was cooled slowly. This magnetic transition was accompanied by a structural transition from hexagonal (NiAs-type) to orthorhombic (MnP-type) structure. We have observed that after the heat treatment, the sample showed a large change in the magnetocaloric effect depending on the cooling condition. From the isothermal *M–H* curves, the changes in the magnetic entropy ($-\Delta S_{mag}$) was determined between 280 and 320 K for different magnetic fields.[1]

For the sintered samples of slow cooling and water quenching, the maximum magnetic entropy change at the magnetic field of 1.5 T were 19.6 and 32.2 J/Kg·K, respectively. Such a significant difference between the maximum entropy changes is due to the degree of the structure distortion, depending on the various heat treatments.

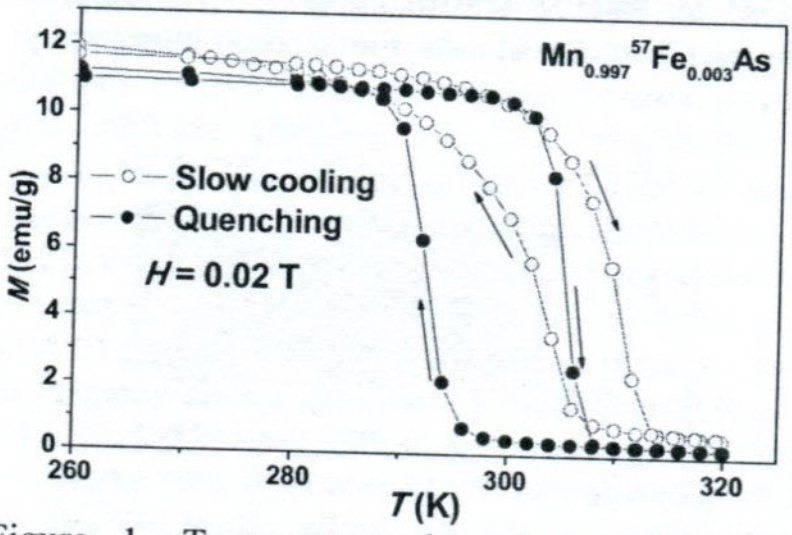

Figure 1. Temperature dependence of the magnetization of $Mn_{0.997}{}^{57}Fe_{0.003}As$ for an external magnetic field of 0.02 T.

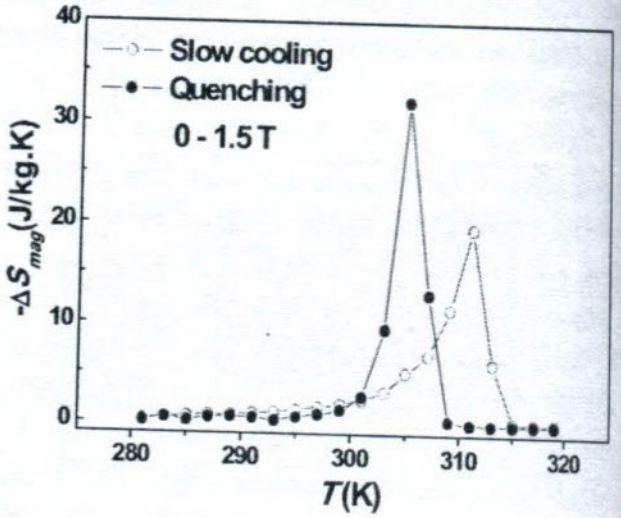

Figure 2. Magnetic entropy changes of $Mn_{0.997}{}^{57}Fe_{0.003}As$ for an external magnetic field change of 1.5 T.

[1] A. de Campos, D. L. Rocco, A. Carvalho, G. Magnus, L. Caron, A. A.Coelho, S. Gama, L. M. D. Silva, F. C. G. Gandra, A. O. D. Santos, L. P. Cardoso, P. J. von Ranke, and N. A. de Oliveira, Nature Mater. **5** (2006), 802.