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Magnetocaloric effect for Mn$_{1-x}$Fe$_x$As

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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](image1.png)  
**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](image2.png)  
**Figure 2.** Magnetic entropy changes of Mn$_{0.997}^{57}$Fe$_{0.003}$As for an external magnetic field change of 1.5 T.