

GIANT MAGNETOCALORIC EFFECT IN $\text{Mn}_{1-x}\text{T}_x\text{As}$

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The MnAs ferromagnet belongs to intermetallic compounds with the largest magnetocaloric effect (MCE), which is governed by strong first order magnetostructural transition from hexagonal (NiAs type) to orthorhombic (MnP type) structures. We have studied the MCE amplitude in $\text{Mn}_{1-x}\text{T}_x\text{As}$ (T = V, Cr, Fe, Co with x=0.01) series of compounds. Magnetisation measurements in d.c. magnetic field were carried out (B = 10 T, T = 4.2-400 K) and magnetic field induced phase transitions were investigated. Based on the isothermal $M_T(H)$ magnetisation curves, the entropy change ΔS was deduced. In order to elucidate the MCE mechanism electronic structure of $\text{Mn}_{1-x}\text{T}_x\text{As}$ was calculated by KKR-CPA method. It was found that all T atoms diluted in MnAs possess magnetic moments which are coupled either ferromagnetically i.e. V ($1.3 \mu_B$), Cr ($2.6 \mu_B$) and Fe ($2.3 \mu_B$) or antiferromagnetically Co ($-1 \mu_B$) with respect to Mn ($3.03 \mu_B$). The magnetic entropy change is discussed in view of total energy KKR-CPA results. We conclude that all samples should be classified as giant magneto-caloric effect compounds, since the magnetic entropy change was found as 2-3 times higher than in pure MnAs (e.g. for T= Cr, $\Delta S \approx 25 \text{ J/kgK}$).

13.4 cm

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9.7 cm