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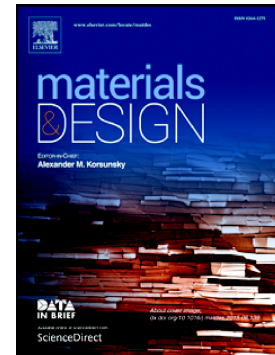
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Magnetocaloric effect of the $\text{LaFe}_{11.2}\text{Co}_{0.7}\text{Si}_{1.1}$ modified by partial substitution of La by Pr or Ho

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Abstract:

The aim of present paper was to study the structure and magnetocaloric effect in $\text{La}_{0.9}\text{X}_{0.1}\text{Fe}_{11.2}\text{Co}_{0.7}\text{Si}_{1.1}$ (where X= Pr, Ho) alloys. The XRD investigation revealed a coexistence between the expected $\text{La}(\text{Fe},\text{Si})_{13}$ - type phase and minor fraction of $\alpha\text{-Fe}(\text{Co},\text{Si})$ in both samples. Moreover, a significant decrease in the lattice parameter of the $\text{La}(\text{Fe},\text{Si})_{13}$ phase for sample doped by Ho, compared to specimen modified by Pr, was detected. The values of the Curie temperature reach 259 and 263K for the Pr and Ho doped sample, respectively. The calculated values of magnetic entropy change equaled 15.73 and 10.91 J/(kg K) under the change of external magnetic field $\mu_0\Delta H=5\text{T}$ for the $\text{La}_{0.9}\text{Pr}_{0.1}\text{Fe}_{11.2}\text{Co}_{0.7}\text{Si}_{1.1}$ and $\text{La}_{0.9}\text{Ho}_{0.1}\text{Fe}_{11.2}\text{Co}_{0.7}\text{Si}_{1.1}$ alloys, respectively. Based on the field dependence of magnetic entropy change ($\Delta S_M = C \cdot (B_{\max})^n$), the exponent n has been calculated and at the Curie point its values equaled 0.64 and 0.65 determined for $\text{La}_{0.9}\text{Pr}_{0.1}\text{Fe}_{11.2}\text{Co}_{0.7}\text{Si}_{1.1}$ and $\text{La}_{0.9}\text{Ho}_{0.1}\text{Fe}_{11.2}\text{Co}_{0.7}\text{Si}_{1.1}$ alloys, respectively. These values correspond well with theoretical predictions.

Keywords: XRD, magnetocaloric effect, $\text{La}(\text{Fe},\text{Si})_{13}$ alloys

1. Introduction.

The relatively low efficiency of the gas vapor/compression process causes enormous consumption of energy in domestic refrigerators. A more promising cooling method is magnetic refrigeration based on the magnetocaloric effect. The magnetocaloric effect (MCE) is an intrinsic property in magnetic materials that results in a change in temperature of the

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