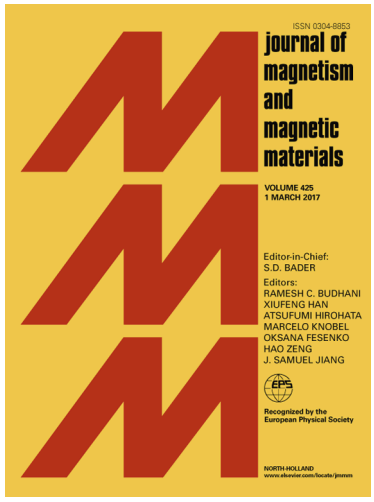

Research articles

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PII: S0304-8853(17)30813-2
DOI: http://dx.doi.org/10.1016/j.jmmm.2017.05.050
Reference: MAGMA 62754

To appear in: *Journal of Magnetism and Magnetic Materials*

Received Date: 7 March 2017
Accepted Date: 16 May 2017

Please cite this article as: Y.V. Kudryavtsev, A.K. Melnyk, V.V. Trachevskyi, I. Gościańska, J. Dubowik, Effect of short-range order on magnetic and transport properties of Fe_2MnGa Heusler alloy films, *Journal of Magnetism and Magnetic Materials* (2017), doi: http://dx.doi.org/10.1016/j.jmmm.2017.05.050

Effect of short-range order on magnetic and transport properties of Fe_2MnGa Heusler alloy films

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Abstract

$Fe_{56}Mn_{20}Ga_{24}$, $Fe_{46}Mn_{35}Ga_{19}$ and $Fe_{39}Mn_{25}Ga_{36}$ Heusler alloy (HA) films are investigated. It is shown that as-deposited Fe-Mn-Ga films are fine crystalline with a body-centered cubic (BCC) structure. Annealing of the films leads to the formation of a face-centered cubic (FCC) structure. The BCC to FCC transformation results in a drastic increase in the magnetization, the Curie temperature as well as in a change of the sign of temperature coefficient of resistivity from negative to positive. These effects are discussed in terms of band structures of $L2_1$ and $L1_2$ phases of stoichiometric Fe_2MnGa HA.

Keywords:
Heusler alloy films, short range order, magnetic properties, transport properties, phase transition
PACS 73.91.-r, 75.70.Ak, 76.50.+g, 81.30.Hd

1. Introduction

Fe_2MnGa Heusler alloy (HA) represents an interesting alternative [1, 2, 3, 4, 5, 6, 7, 8, 9] to the archetype of ferromagnetic shape memory alloy Ni_2MnGa exhibiting a characteristic metastability with respect of martensitic transformation [10, 11]. In comparison to Ni_2MnGa, the situation in Fe_2MnGa (or Fe-Mn-Ga in general) is even more complicated since, besides the martensitic instability [1, 3], BCC and FCC types of structure are almost equally thermodynamically probable [1, 12]. Experimentally determined ternary phase diagrams for bulk Fe-Mn-Ga alloys have shown that either BCC or FCC structure or a mixed phase of BCC and FCC

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