METAMAGNETISM OF THE Fe_2MnGa HEUSLER ALLOY

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Magnetic properties and electronic structure of bulk and film Fe_2MnGa Heusler alloy (HA) samples have been investigated. It was verified that unlike most of full stoichiometric Heusler compounds, ferromagnetic bulk stoichiometric Fe_2MnGa with the Curie temperature of 780 K crystallizes in the ordered FCC lattice of Cu_3Au type with small amount of B2-phase. According to the results of our first-principle calculations free electron energy of ferromagnetic (FM) [$\mu_{total} = 6.78\mu_B$, $\mu_{Fe} = 2.19\mu_B$, $\mu_{Mn} = 2.55\mu_B$ and $\mu_{Ga} = -0.10\mu_B$] FCC phase is lower by about 0.06 eV than that of antiferromagnetic (AFM) phase with $L2_1$ structure. In a temperature range of 80 - 110 K a FM to AFM transition was observed with field cooling magnetization measurments. Additionally, Fe_2MnGa revealed metamagnetic behavior since increase in magnetic field suppresses the AFM spin arrangement. Depending on deposition conditions Fe_2MnGa films revealed a mixed structure: mainly BCC or FCC phases with some admixture of FCC or BCC phases, respectively. Fe_2MnGa HA films with mainly BCC structure show the same behavior as the bulk samples: the magnetization increases with decrease in temperature from the Curie temperature ($T_C \approx$300 K) up to 110 K and then abruptly decreases up to zero due to transformation to AFM phase. According to DSC analysis FM/AFM transition of Fe_2MnGa films is not accompanied with any structural changes.

9.7 cm

13.4 cm

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