EXCHANGE BIAS IN Ni-Mn-Sn HEUSLER ALLOY FILMS

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9.7 cm

Exchange bias (EB) has been recently observed in NiMn-based Heusler bulk alloys. It has been shown that it results from coexisting ferromagnetic (FM) and antiferromagnetic (AFM) phases. We report a relatively large EB effect observed for the first time in Ni-Mn-Sn thin films with different microstructure and composition. The thin film structures prepared by magnetron sputtering comprise: a $MgO/Ni_{50}Mn_{36}Sn_{14}$ (200 nm) off-stoichometric epitaxial film with clearly visible martensitic transformation at $T \approx 125$ K (sample A), a $Si/Ni_{50}Mn_{43}Sn_7$ (100 nm) film phase decomposed into (AFM) $Ni_{50}Mn_{50}$ and (FM) $Ni_{50}Mn_{25}Sn_{25}$ (sample B), and a $Si/NiMn(50\ nm)/Ni_{50}Mn_{25}Sn_{25}$ (30 nm) bilayer with AFM/FM interface but without any EB near room temperature (sample C). Despite the samples differ markedly in both microstructure and composition the substantial EB is present at low temperature region $4 < T < 80$ K. The highest EB effectis observed in phase decomposed sample B with overdeveloped AFM/FM interfaces. EB decreases with increasing T approximately as $H_{EB}(T) \propto H_{\mathrm{EB}}(4\mathrm{K})/\mathrm{T}$. $H_{\mathrm{EB}}(4\ \mathrm{K})$ amounts to 190 Oe, 65 Oe and 60 Oe for sample B, A and C, respectively. Blocking temperature where the EB vanishes is 40, 50 and 80 K for sample A, C and B, respectively. The results suggest that the role of AFM/FM interfaces is small (but not negligible) in formation of EB in Ni-Mn-Sn Heusler alloy films and EB is rather related to AFM/FM interactions in nanoscale.

13.4 cm

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