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Suppression of reentrant spin glass and induced zero-field-cooled exchange bias by lattice contraction in NiMnSbAl alloys

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Abstract: In this work, the evolution of magentic ground state and exchange bias (EB) with Al substitution in $Ni_{50}Mn_{37}Sb_{13-x}Al_x$ Heusler alloys was investigated in detail. Al doping reduces the cell volume, enhancing antiferromagnetic interactions between Mn atoms and changing the ground state from "reentrant" spin glass (RSG) to spin glass. The conventional EB increases greatly from 314 Oe for x=0 to 6682 Oe for x=10. More interestingly, the zero-field-cooled EB begans to emerge at x=6 where RSG is surppressed and reaches a maximum value at x=8. These results imply that tuning cell volume provides an effective way to adjust the strength of exchange interaction and further modulate EB in Ni-Mn-based Heusler alloys.

Key words: Zero-field-cooled exchange bias; Reentrant spin glass; Spin glass; Magnetic phase diagram; Ni-Mn-Sb

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