Accepted Manuscript

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PII: S0925-8388(16)33128-0

DOI: 10.1016/j.jallcom.2016.10.020

Reference: JALCOM 39187

To appear in: *Journal of Alloys and Compounds*

Received Date: 26 January 2016

Revised Date: 22 September 2016

Accepted Date: 3 October 2016

Please cite this article as: D. Zheng, Z. Li, Y. Zhang, P. Huang, K. Xu, C. Jing, Magnetostructural transformation and its multiple functional properties for Co-doped $Ni_{56}Mn_{18}Ga_{26}$ Heusler alloy, *Journal of Alloys and Compounds* (2016), doi: 10.1016/j.jallcom.2016.10.020.

Magnetostructural transformation and its multiple functional properties for Co-doped $Ni_{56}Mn_{18}Ga_{26}$ Heusler alloy

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Abstract The crystal structures, martensitic transformations (MT) and magnetic properties of polycrystalline $Ni_{56-x}Co_xMn_{18}Ga_{26}$ (x=0, 1, 2) alloys have been investigated comprehensively. These alloys exhibit an unmodulated martensitic structure ($L1_0$) at room temperature. In the Co free alloy, a magneto-structural coupling MT is presented. With increasing Co content, however, the MT moves to a higher temperature and finally partly splits off from ferromagnetic transition at x=2. Simultaneously, two successive magneto-structural transformations were observed at x=1, which could be ascribed to the existence of an intermartensitic transition (7M↔$L1_0$). Owing to the evolution of MT with Co doping, the magnetization of paramagnetic (PM) austenite is increased slightly, while the ferromagnetic (FM) martensite is almost unchanged. The multiple functional properties associated with the field-induced MT were also investigated in these alloys. It was found that the optimized magnetostrain amounts to ~0.12% in the alloy with x=2. In addition, the refrigerant capacity (RC) with the values of 50 J/kg and 49 J/kg were obtained in the alloy with x=0 and x=1, respectively.

Key-words: Heusler alloy, Martensitic transformation, Magnetostrain, Magnetocaloric effect

PACS: 75.50.Cc, 81.30.kf, 75.80.+q, 75.30.Sg

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