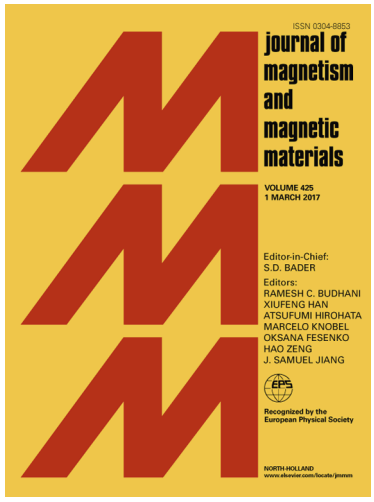

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Abstract We have systematically investigated the exchange bias (EB) effect and low-temperature magnetic state transition in $Mn_{42}Cu_6Ni_{42}Sn_{10}$ Heusler alloy by means of AC and DC magnetization measurements. Experimental results suggest that the martensitic phase is in the state of superparamagnetic (SPM), following that the particles turn into the ferromagnetic (FM) state at the martensitic Curie temperature, and the moments are frozen as the temperature is below 150 K. In addition, EB effect was observed in the phase separated martensitic state, which can achieves about 536 Oe under the field of 500 Oe after field-cooled (FC) to 10 K. First-principle investigations indicate that such a small value is originated from nonmagnetic Cu atoms substitution. The appearance of EB effect can be ascribed to the competition between the FM martensitic phase and spin glass (SG) phase due to the impact of Mn atoms, whereas the nonmagnetic Cu atoms doping would destruction the magnetic aggregation, resulting the small EB value eventually.

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