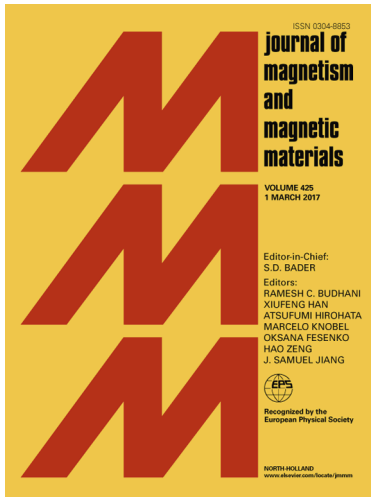

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Effect of Nb doping on the microstructure and magnetic properties of Nd-Ce-Fe-B alloy

Qichen Quan[1], Lili Zhang[1], Qingzheng Jiang[1], Weikai Lei[1], Qingwen Zeng[1], Xianjun Hu[1], Lei Wang[1,a)], Xi Yu[2], Junfeng Du[2], Gang Fu[3], Renhui Liu[1], Minglong Zhong[1], Zhenchen Zhong[1,b)]

[1] *Jiangxi Key State Laboratory for Rare Earth Magnetic Materials and Devices/ Institute for Rare Earth Magnetic Materials and Devices (IREMMD), Jiangxi University of Science and Technology, Ganzhou, 341000, P. R. China*

[2]*Ganzhou Fortune Electronic Ltd., Ganzhou, 341000, P. R. China*

[3]*Fujian Changting Golden Dragon Rare-Earth Co., Ltd., 366300, P. R. China*

Abstract

With the intention to reduce the Nd content in $Nd_2Fe_{14}B$-type alloys, 20 at.% Ce and 0.5 at.% Nb substituting Nd and Fe in the $Nd_{13}Fe_{82}B_5$ alloys were previously employed to improve successfully the coercivity and the thermal stability without the energy product reduction. In this study, a light increase of the remnant polarization J_r was observed in $(Nd_{0.8}Ce_{0.2})_{13}Fe_{82-x}Nb_xB_5$ alloy at x=0.5 and x=1.0, resulting from the increasing amount of α-Fe phase. The optimum magnetic properties obtained with 0.5 at.% Nb doping are H_{cj}=13.1 kOe, J_r=0.79 T, $(BH)_{max}$=13.3 MGOe, respectively. Besides, the coercivity H_{cj} and maximum energy product $(BH)_{max}$ for the melt-spun ribbons with 0.5 at.% Nb addition are higher than those of the Nb-free ribbons in the temperature range of 300-450 K. Both the variations of Curie temperature T_c and a increase of lattice constants *a* and *c* of the hard magnetic phase with Nb addition imply that some of Nb atoms may directly enter into the hard magnetic phase, occupying the Fe sites. With the analysis on the demagnetization curve, Henkel curve and the observation of transmission electron microscope (TEM), the results indicate that a small amount of Nb can enhance the coercivity and exchange coupling though improving the microstructure of alloys.

Keywords: Nb doping; Exchange coupling; Microstructure; Magnetic properties; Nd-Ce-Fe-B alloys

Corresponding author: