Nb Effect on Soft Magnetic Properties in Fe$_{81-x}$Nb$_x$B$_{12-x}$ (x=0,0.5) Ribbons Fabricated by Single Melt-spun Method

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1. INTRODUCTION

The Fe–M–B (M=Zr, Hf and Nb) type alloys as a soft magnetic materials have been investigated by K. Suzuki et al.[1]. The addition of Nb in the FeB alloy lead to inhibit the growth of crystalline in heat treatment. And about the annealing effect on the magnetic properties of nanocrystalline Fe$_{80.5}$Nb$_{0.5}$B$_{12.5}$ was researched by I. Skorvanek et al.[2]. The minimum value of coercivity is found after annealing of specimens in the temperature range 610–630 ºC. The aim of this paper is to contribute to understanding effect of Nb on the magnetic properties with the different composition.

2. EXPERIMENTAL

The Fe$_{81}$Nb$_{0.5}$B$_{12}$ and Fe$_{80.5}$Nb$_{0.5}$B$_{12.5}$ casts were prepared by vacuum induction furnace. The constituent elements with 99.9 wt% purification were melted in a quartz crucible under argon atmosphere. Then the casts were crushed into small size to be suitable for the next step. The quartz crucible with a nozzle (diameter 0.5 mm) was used. The FeNbB ribbons were made by R.S.P (Rapid Solidification Process) system under the argon atmosphere with 60 m/sec wheel velocity, 2 atm argon pressure and then heat treated for 1 hour at 500 ºC, 550 ºC, and 600 ºC, respectively. After that, the magnetic properties were measured by the VSM (Vibration Sample Magnetometer) magnetometry, MOKE (Magneto Optical Kerr Effect) magnetometer, and the MI (Magneto Impedance) properties were measured.

3. RESULT

The soft magnetic Fe$_{81-x}$Nb$_x$B$_{12-x}$ (x=0,0.5) amorphous ribbons were fabricated by single melt-spun method successfully. The width and thickness of ribbons were about 0.5 mm and 10 µm. According to analysis of the hysteresis loop with the heat treated ribbons, it can be shown that the coercivity (H$_c$) of the Fe$_{81}$Nb$_{0.5}$B$_{12}$ sample increased obviously when heat treated at 600 ºC. The H$_c$ can reach 16.8 Oe but the coercivity improvement of Fe$_{80.5}$Nb$_{0.5}$B$_{12.5}$ ribbons is not remarkable.

4. REFERENCES