The Effect of Annealing on Magnetic Properties of Co-based Amorphous Alloy Ribbons

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1. Introduction

Amorphous alloys are being developed for use in motors, sensor, and electromagnetic shielding applications. Especially, Co-based amorphous alloys with nearly zero magnetostriction are the suitable characteristic for magnetic cores. However, amorphous structure is in a metastable state due to rapid quenching, so further annealing treatment is necessary to optimize magnetic properties. The effect of annealing has been investigated for a number of amorphous alloys and been found that the annealing cause reduction of coercivty and losses. In this study, the annealing effect on the magnetic properties of Co-based amorphous ribbon was investigated

2. Experiment

Alloy ingots with the composition $Co_{72}B_{19.2}Si_{4.8}Cr_4$ and $Co_{64.8}Fe_{7.2}B_{19.2}Si_{4.8}Cr_4$ were prepared by arc-melting mixtures of high purity constituent elements under a Ti-gettered argon atmosphere. Amorphous ribbons with 2 mm width and 20-30 μm thickness were produced by melt spinning in an argon atmosphere. The melt-spun ribbons were subjected to annealing treatments at various temperatures below glass transition temperature for 15 minutes in a vaccum. The composition and structure of ribbons identified by X-ray diffraction with Cu-Kα radiation. Thermal stability associated with the crystallization temperature and glass transition temperature were measured using a differential scanning calorimeter and thermomechanical analysis under a flowing argon atmosphere. The magnetic properties including saturation magnetization and coercivity at room temperature were measured in a maximum applied field of 20,000 Oe by using a vibrating sample magnetometer with field resolution of 1 mOe.

3. Result and discussion

The annealing effect on the magnetic properties is reported for the Co-based amorphous ribbons. All of the ribbon with or without heat treatment was identified as a fully amorphous alloy in X-ray diffration patterns. We confirmed that heat treatment contributes to soft magnetic properties. The lowest value of coercivity was 0.082 Oe after annealing for 15 minutes at 450°C for $Co_{64.8}Fe_{7.2}B_{19.2}Si_{4.8}Cr_4$.

4. References

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