

Magnetic and Thermal Properties in the Fe-based amorphous alloy with Zr and Nb

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1. Introduction

It is widely known that Fe-based amorphous alloys have good soft magnetic properties which cannot be gained for crystalline magnetic alloys. Besides, the addition of Co improves soft magnetic properties such as high saturation magnetization (M_s), low coercivity (H_c), and glass forming ability (GFA) in Fe-based amorphous alloys. It is well known that metalloids (such as B, P, and Si) play an important role in the GFA in Fe-based amorphous. In this study, we added B to improve the GFA and thermal stability. Similar to the B, Zr improves thermal stability. The famous alloy system with nanocrystalline microstructures known as HITPERM, Fe-Zr-B alloy, is likely to exhibit high M_s and low H_c . Furthermore, we added small Nb to improve the structural properties and the thermal stability.

The purpose of this work is to find alloys that have good soft magnetic properties such as high M_s , low H_c by analyzing magnetic properties in (Fe, Co)-(Zr, Nb)-B alloys with appropriate machines.

2. Experiment

For this research, ingots which weigh 6g were prepared by using arc-melting under a Ti-gettered Ar atmosphere mixture of Fe slug (99.95%), Co slug (99.95%), Zr pieces (99.95%), Nb slug (99.95%), and B pieces (99.5%). Each of them transformed into ribbons with width of 2mm by melt-spinning under Ar atmosphere at a wheel speed of 56.3 m/s. The amorphous structure with no crystalline peak could be confirmed by X-ray diffraction (XRD) using a Cu-K α radiation. Thermal properties were obtained by Differential scanning calorimeter (DSC). Magnetic properties were obtained by vibrating sample magnetometer (VSM).

3. Result and discussion

In this study, we analyzed the magnetic and thermal properties of the (Fe, Co)-(Zr, Nb)-B alloys, and found the optimized composition that has good soft magnetic and thermal properties. HITPERM alloys (such as Fe-Zr-B system) have high M_s and low H_c . Therefore the addition of Zr and Nb in Fe-based amorphous alloys is expected to have good magnetic and thermal properties.

4. References

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