EB07

Influence of Cr on Magnetic Properties and Temperature Coefficient for Nanocomposite $Nd_{9.5}Fe_{76-x}Co_5Zr_3B_{6.5}Cr_x$ (x=0-1.5) Magnets

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Nanocomposite $Nd_2Fe_{14}B/\alpha$-Fe magneticmaterials consisting of magnetically hard and soft phases are very promising candidates for a new generation of permanent magnets because of its low rare earth cost, high remanence and maximum energy product [1-3]. However, the high temperature coefficients of Jr and iHc limited its application in higher temperature [4]. *The elemental addition is an effective way to improve thermal stability of materials. In present work,* the effect of Cr addition on the magnetic properties and temperature coefficient of nanocomposite Nd_2Fe_{14} (x=0-1.5) magnets is investigated. Alloy ingots with nominal compositions of $Nd_{9.5}Fe_{76-x}Co_5Zr_3B_{6.5}Cr_x$ (x=0-1.5) were produced by arc-melting from Nd, Fe, Co, Zr, Cr and Fe-B constituents under a high-purity Ar atmosphere. Small pieces of the arc-melted buttons were melt-spun using a single roller Cu wheel at a wheel speed of 16m/s. The melt-spun ribbons were annealed in the temperature of 670℃ for 4min. The powder obtained by grinding the annealed ribbons was bonded with 2% (mass fraction) epoxy resin and compressed to a Φ10mm×10mm magnet about 6.2g/cm³ density.

It was found that the room-temperature magnetic properties of the magnets were remarkably improved with Cr substitution due to the grain refinement. The optimal magnetic properties of J_r=0.77T, $_iH_c$=768kA/m and $(BH)_{max}$=83kJ/m³ were obtained for 1.0at% Cr substitution. *Proper Cr (1.0at%Cr) substitution can improve the temperature coefficientsof remanence (α) and* coercivity (β) for $Nd_{9.5}Fe_{76-x}Co_5Zr_3B_{6.5}Cr_x$ bonded magnets.(Fig. 1)

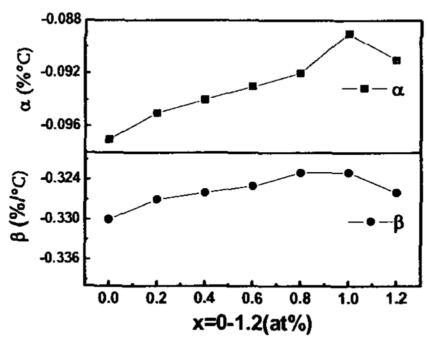

Fig. 1. Temperature coefficients of (a) remanence and (b) coercivity for $Nd_{9.5}Fe_{76-x}Co_5Zr_3B_{6.5}Cr_x$ bonded magnets.

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EB08

Effects of Magnetic Field Annealing on Magnetic Properties and Microstructure of Nd-Fe-B-Ti-C based Nanocomposite Permanent Magnet

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1. Introduction

The material processing with a strong static magnetic field has been researched along with the spread of superconducting magnets in recent years. Application of magnetic fields in annealing is reported to be effective to improve magnetic properties of various magnetic materials [1, 2]. We have developed Ti-and-C-added Fe-$B/Nd_2Fe_{14}B$ nanocomposite magnets with Nd content from 6-9 at.% and B content from 10-15 at.% [3, 4]. Recently we investigated possibility of advanced annealing processing for this type of magnets in order to improve their properties. Here, we report the effects of static magnetic field on structural and magnetic properties.

2. Experimental Procedures

Rapidly solidified ribbons were prepared by melt spinning technique onto a Cu wheel rotating at a surface speed of 5-20 m/s in Ar atmosphere. The ribbons were then annealed at 600-800°C for 6 minutes in Ar atmosphere with/without static magnetic field. Annealing was performed with a furnace placed in the bore of a liquid-He-free superconducting magnet. Magnetic properties of the annealed ribbons were measured with a VSM. Crystalline phases in the annealed ribbons were examined by means of XRD analysis. Structures of the annealed ribbons were examined with a TEM.

3. Results and Discussion

Rapidly solidified ribbons of $Nd_9Fe_{73}B_{12.6}C_{1.4}Ti_3Nb_1$ at.% at a surface speed of 9 m/s are mixture of amorphous and crystalline phases. Fig. 1 shows demagnetization curves of the ribbons annealed at 740°C. Fig. 2 shows the microstructures of annealed ribbons. Improved magnetic property of the ribbonannealed with static magnetic field may be attributed to the uniformly fine grain sizes.

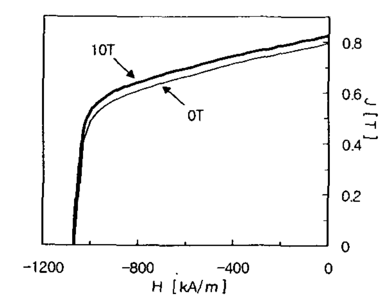

Fig. 1. Demagnetization curves of ribbons annealed at 740°C

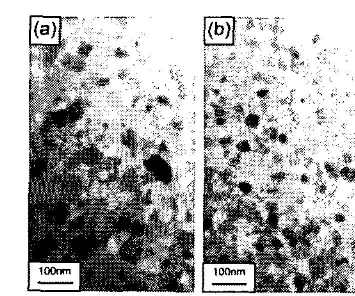

Fig. 2. TEM bright image of the ribbons annealed in magnetic field (a) 0T / (b) 10T

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