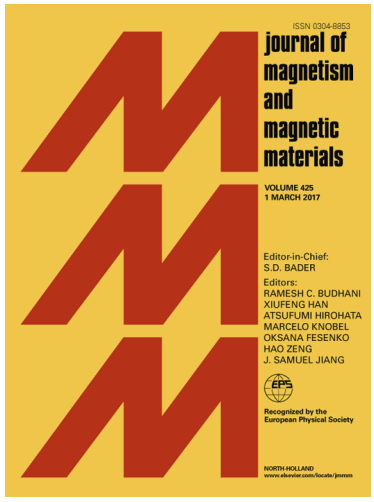

Research articles

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Synthesis, microstructures, magnetic properties and thermal stabilities of isotropic alnico ribbons

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Abstract

Reducing the spatial dimension of ferromagnetic (α_1) phase is the most promising route for coercivity enhancement of alnico alloys. It is an experimental fact that the spatial dimension of α_1 phase cannot be reduced below a certain limit (~25 nm) using conventional processing methods. To obtain finer α_1 phase we have fabricated alnico ribbons with nominal composition of 32.2Fe-36Co-13.5Ni-7.6Al-6.2Ti-3.8Cu-0.5Zr-0.2B by melt spinning and subsequent heat treatments. Very fine Fe-Co rich (α_1) rods of the order of 5 nm diameter and 100 nm length embedded in Al-Ni rich matrix are obtained. After simplified heat treatment the properties of the isotropic ribbons are H_{cj} = 770 Oe, B_r = 6.5kGs and $(BH)_{max}$ = 1.86MGOe. It is shown that alnico ribbons have unprecedented thermal stability described in terms of temperature coefficient of remanence (α) and temperature coefficient of coercivity (β) by measuring magnetic properties at high temperatures (~800K). The microstructures of the alloys have been analyzed by Optical Microscope, Scanning Electron Microscope and Transmission Electron Microscope. The phase transition temperatures have been observed by DTA and magnetic properties are measured by PPMS.

Key words: alnico ribbons, spinodal decomposition, thermal stability, magnetic properties, phase transition temperatures

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1. Introduction

Permanent magnets (PMs) are mainly composed of ferrites, alnico, and rare earth (RE) based magnets (such as NdFeB and SmCo). RE-based permanent magnets have obvious advantages over the non rare earth magnets (ferrites, alnico) in terms of coercivity H_{cj}, energy