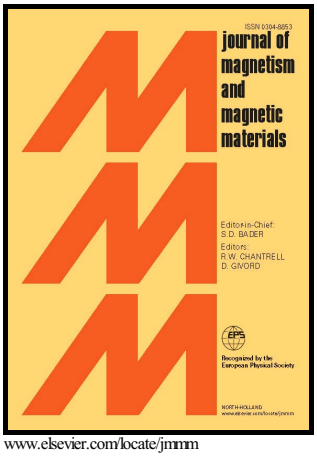

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PREPARATION AND PROPERTIES OF COBALT-BASED SOFT MAGNETIC MATERIAL PREPARED BY NOVEL POWDER METALLURGY

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Abstract

The present work deals with the development of nanocrystalline 60Co–26Fe-14Al (wt%) soft magnetic materials via mechanical milling of elemental powders. The evolution of solid solution during milling proceeded with continuous decrease in atomic order and the crystallite size, and an introduction of internal strain and dislocations. The milling-induced lattice defects, crystallite size reduction, and atomic disorder exhibited a decrease in saturation magnetization, remanence magnetization, squareness ratio, and blocking temperature with increasing milling time. It has been demonstrated that, at subzero temperatures, the magnetization decreases with increasing temperature due to the development of an effective anisotropy caused by an evolution of canted spin structure owing to the introduction of lattice defects during milling.

Keywords: Powder metallurgy; Nanocrystalline; Cobalt-Iron-Aluminium; Magnetism; Dislocation density.

1. Introduction

Recently spin-electronics based industries have attracted scientific interest. But spin-polarized current and electron transfer be the major challenges. To overcome this problem, Half-metallic ferromagnet's (HMF's) be the potential candidate [1]. These HMF's were first predicted by de-Groot [2-5]. They exhibit strongly metallic in one spin and semiconducting in other spin at the fermi energy (E_F) level, that results in 100% spin polarization [6]. On the atomic level heusler compounds, half-metallicity directly related to the structural disorderness. According to band structure calculation, disordering in atomic position would reduce the spin polarization [1, 7]. Reduction of size to nano-scale would increase the disorder. So, nanostructured materials are proven to be perfect for developing relation between magnetic nature and structural disorder [8, 9]. Cobalt-based heusler compounds have attracted primary interest due to high curie temperature (T_c) and low atomic disordering [10]. Galanakis et al., theoretically predicted 84%

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