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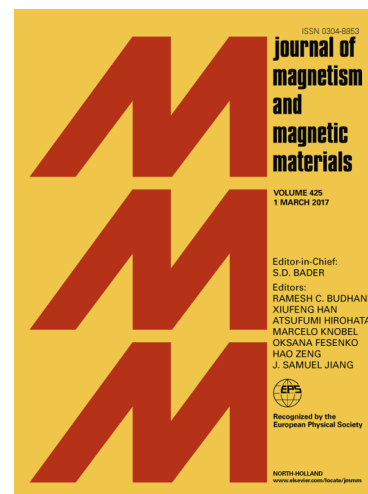
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Structure and magnetic properties of Alnico ribbons

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Abstract: Al-Ni-Co alloy has been widely applied in various industrial fields due to its excellent thermal and magnetic stability. In this paper, new Al-Ni-Co ribbons are prepared by simple processes combining melt-spinning with annealing, and their phase transition, microstructure and magnetic properties are studied. The results show that after as-spun ribbons are annealed, the grain size of ribbons increases from $1.1\pm 0.3\ \mu\text{m}$ to $4.8\pm 0.8\ \mu\text{m}$, but still much smaller than that of the bulk Al-Ni-Co alloy manufactured by traditional technologies. In addition, some rod-like $\text{Al}_{70}\text{Co}_{20}\text{Ni}_{10}$ -type, Al_9Co_2 -type and Fe_2Nb -type phases are precipitated at grain boundaries; simultaneously, the distinct spinodal decomposition microstructure with periodic ingredient variation is thoroughly formed in all grains by the reaction of $\alpha \rightarrow \alpha_1 + \alpha_2$. Furthermore, the α_1 and α_2 distribute alternately like a maze, the Fe-Co-rich α_1 phase holds 35.9-47.3 vol%, while the Al-Ni-rich α_2 phase occupies the rest. Finally, the coercivity of annealed ribbons can reach to $485.3\pm 76.6\ \text{Oe}$. If the annealed ribbons are further aged at $560\ ^\circ\text{C}$, their H_c even increases to $738.1\pm 81.0\ \text{Oe}$. The coercivity mechanism is discussed by the combination of microstructure and domain structure.

Keywords: Magnetically ordered materials; Rapid-solidification; TEM; Microstructure; Magnetic properties

1. Introduction

The Al-Ni-Co alloy (normally abbreviated as Alnico) had become a significant milestone of permanent magnetic materials since it was first discovered by Mishima [1] in 1931, and it developed rapidly between the 1930s and 1960s. In the early 1960s, it was found that the microstructure formed by spinodal decomposition in Alnico alloy was an important origin of high hard magnetic properties [2]. In a certain temperature region, the spinodal decomposition of solid solution α will occur and form the ferromagnetic Fe-Co-rich α_1 phase and weak ferromagnetic Al-Ni-rich α_2 phase, namely following the reaction of $\alpha \rightarrow \alpha_1 + \alpha_2$. The size, shape, distribution and

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