

□ **The Influence of Pr Concentration on the Magnetic Properties of Pr-Fe-Co-B-Nb
HDDR Magnets**

C.C.T.M.
L. P. Barbosa, N. A. Ferreira; H. Takiishi; R. N. Faria
Instituto de Pesquisas Energéticas e Nucleares,
IPEN-CNEN-S.Paulo, Brazil
luzinete@net.ipen.br

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Abstract: Permanent magnets were produced from homogenized alloys using the hydrogenation, disproportionation, desorption and recombination (HDDR) process. The influence of Pr concentration on the magnetic properties of these magnets was studied. Under the present processing conditions Pr has a significant influence on the magnetic behaviour of these magnetic alloys. Microstructural examinations revealed that free iron was completely eliminated from all studied alloys with annealing.

Introduction

In the past, Pr-based magnetic powders have been produced via the HDDR process, but with inferior magnetic properties, compared to Nd-based materials [1]. Ga containing Pr-type HDDR powders with good remanence have also been reported [2] but intrinsic coercivity in these materials was still quite poor. However, it has been shown that anisotropic powders based on the composition $\text{Pr}_{13.7}\text{Fe}_{61}\text{Co}_{16.7}\text{B}_6\text{Nb}_{0.1}$, with good remanence and coercivity, can be produced by this process [3-7]. This study was undertaken to optimise the praseodymium content with respect to the magnetic properties of the HDDR permanent magnets. The microstructures of the annealed alloys were observed with a scanning electron microscope (SEM).

Materials and Methods

Commercial alloys in the as-cast state and after annealing in vacuum at 1100°C for 20 h were studied. The details of the preparation of the HDDR magnets, alloy homogenisation heat treatment and magnetic measurements have all been described in previous papers [4-7]. Permeameter measurements were performed after saturation in a pulsed field of 6.0 T. Remanence values have been normalized assuming 100% density for the HDDR sample, and by also considering a linear relationship between density and remanence. Microstructural characterization of the alloys was carried out with the aid of a scanning electron microscope (SEM).

Results and Discussion

Back-scattered electron images of the annealed praseodymium-based alloys are shown in Figures 1-5. It can be seen clearly that annealing at 1100°C for 20 h was quite effective in homogenizing all the alloys. Free iron (αFeCo)

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