The Effect of Particle Size Distribution on the Magnetic Properties of Pr-Fe-B Sintered Magnets

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This paper reports the results of investigations carried out to determine the influence of the particle size distribution on the magnetic properties of $Pr_{16}Fe_{76}B_8$ sintered magnets. Permanent magnets were prepared from the cast alloy using the powder metallurgy route and the hydrogen decrepitation process. The effect of the balls shape and weight on the particle size distribution was investigated. Spherical milling balls yielded magnetic powder with a single particle size distribution whereas spherical/tori balls yielded hydride powder with a bimodal particle size distribution.

Keywords: Pr-based alloys; bimodal particle distribution; hydrides; magnetic properties

1. Introduction

Milling the magnetic alloy is carried out to produce a narrow size distribution of single crystal particles [1,2]. The roller ball milling proved to be a practical means of producing fine magnetic powder for the fabrication of high quality sintered magnets [3-6]. The rotational movement of the balls within the milling container results in collision, shear and compression forces acting on the cast alloy [7]. The milling velocity is adjusted to ensure operation with the required proportion of balls for cataracting and cascading [7]. Conveniently, milling time can be reduced considerably with the hydrogen decrepitation (HD) process [8]. Average particle size has a significant influence on the magnetic properties of rare earth transition metal magnets and should be below 10 μm [9]. In this study the influence of the particle size distribution (PSD) on the properties of sintered magnets has been investigated by