Volume production of $Nd_2Fe_{14}B/Fe_3B$ nanocomposite powders and their magnetic properties

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Abstract

Magnetic properties of nanocomposites comprising of $Nd_2Fe_{14}B$ and Fe_3B phases are dependent on the size, shape and distribution(volume fraction) of those magnetically hard and soft grains. Especially the grain size and volume fraction of each phase are known to play a direct role in determining the exchange coupling behavior occurring between those soft and hard phases. In this study, we report recent development of volume production technology of nanocomposite melt spun powders in RIST and some results of enhanced data of performance of the $Nd_2Fe_{14}B$+Fe_3B powders. The magnetic properties were characterized in terms of volume fraction of $Nd_2Fe_{14}B$ and Fe_3B phases, which was varied by melt spinning speed during production. The exchange coupling behaviors were determined by plotting Henkel equation illustrating the coupling details. Also detailed volume fraction of each magnetic phase was determined by Mössbauer Spectroscopy. By employing those advanced analysis the nanocomposite melt spun powders consisting of $Nd_2Fe_{14}B$ + Fe_3B powders made in RIST showed the magnetic properties having $H_{ci} > 3.082$ kOe, $B_r > 11.73$ kG, and $(B.H)_{max} > 12.28$ MGOe. It was confirmed that the best magnetic properties of the powders obtained after post annealing at 650 °C for 10 min resulted from the volume fraction of $Nd_2Fe_{14}B$ = 35.6 %, Fe_3B = 60.1 %, and Fe = 0.34 %, rspectively.

Reference
[1] C.J. Yang E.B. Park, "Mossbauer study on $Nd_2Fe_{14}B/Fe_3B$ composite on magnet treated by external magnetic field", J. Magn. Magn. Mater, Vol 167, No. 3, PP. 358, 1997

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References