The Effect of External Magnetic Field on the Microstructure and Magnetic Properties of Melt-Spun Nd–Fe–B/Fe–Co Nanocomposite Ribbons

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Abstract

Nd–Fe–B nanocomposite ribbons are of considerable interest owing to their wide applicability. The magnetic-field-assisted melt-spinning (MFMS) technique has been shown to be advantageous for the production of high-quality single-phase ribbons, but the role of the magnetic field during melt-spinning requires clarification. This study aims to examine the role of the MFMS process in reducing the grain size, enhancing the ribbon texture, and improving the maximum energy product, $(BH)_{max}$, of Nd–Fe–B/Fe–Co nanocomposite ribbons. In this study, The ribbons $Nd_2Fe_{14}B$/Fe–Co ribbons were prepared with athe nominal composition of $Nd_{16}Fe_{76}B_8$/40% wt.% $Fe_{65}Co_{35}$ were prepared by the conventional and the developed magnetic field-assisted melt-spinning (MFMS) techniques. Both The ribbons prepared with both techniques were are nanocomposites with the smooth single-phase-like magnetization loops. AThe 0.32 T magnetic field perpendicular to the wheel surface toand assisting the melt-spinning process reduceds the grain size inside the ribbon, increaseimproveds the texture of the ribbon, and improveenhanceds the exchange coupling., and, in sequence,As a result, increases the energy product$(BH)_{max}$ – $(BH)_{max}$ of the isotropic powdered samples of MFMS ribbon sample prepared by the MFMS technique was increased by in ~9% inby comparison with that of the ribbon prepared by conventional melt spinning-spun conventionally. The effect of magnetic field assistance on grain size reduction effect caused by the assisted magnetic field has was also been describedevaluated quantitatively. The findings of this work indicate that tThe MFMS technique seems to beis promising for the production ofing high-performance nanocomposite ribbons.

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