

Mössbauer study and magnetic properties of Co substitution into Nd₂Fe₁₄B/Fe₃B nanocomposite ribbons

Jong Soo Han¹, Eng Chan Kim^{*1}, Choong Jin Yang², Eon Byeong Park²

¹ Department of Physics, Yeungnam University, 214-1 Dae-dong, Gyeongsan-si, Gyeongsangbuk-do, Korea

² Research Institute of Industrial Science & Technology(RIST), Pohang 790-600, Kyungbook, Korea

*Corresponding author: e-mail: eckim@yu.ac.kr, Phone: +82 53 810 2343, Fax: +82 53 814 6141

The addition of Co was found to enhance the magnetic properties of Nd₂Fe₁₄B/Fe₃B nanocomposite magnets by evaluating Nd₄Fe_{76.5x}Co_xHf_{0.5}Ga_{0.5}B_{18.5}(0≤x≤5).

The enhancements were resulted from the fact that the Co addition retarded the crystallization of Fe₃B and accelerated that of Nd₂Fe₁₄B.[1] The decreased interval between the crystallization temperature of Fe₃B and Nd₂Fe₁₄B enabled the grain growth of each phase to be uniform during post annealing of the melt spun ribbons.

The addition of Co from 0 to 5 at.% increased the coercivity(iHc) from 3.03 to 3.54 kOe with the enhanced remanence(4πMr) around 11.54 kG. By the optimized processing for the nanocomposite magnets of Nd₄Fe_{71.5}Co₅Hf_{0.5}Ga_{0.5}B_{18.5} ribbons spun at 26 m/sec and magnetization annealing at 680 °C for 10 min, the magnetic properties of Br=11.54 kG, iHc=3.54 kOe and (B·H)_{max}=14.35 MGOe were obtained.

The volume fraction of about 75% for Fe₃B, 24% for Nd₂Fe₁₄B and less than 1% for α-Fe, respectively were measured by the Mössbauer spectroscopy analysis. Those volume fractions were found to increase slightly in Nd₂Fe₁₄B and to decrease in Fe₃B with the increase of Co content.

Hyperfine field (H_f) of three inequivalent Fe sites of Fe₃B and six inequivalent Fe sites of Nd₂Fe₁₄B were analyzed with increasing the Co content. No change in H_f was observed for any site of Fe in Fe₃B. But a prominent decrease in H_f for 8_{j2} site compared with the others. And a slight decrease in H_f for 4c sites.

This work was supported by grant No.(R05-2002-000-01511-0) from the Basic Research Program of the Korea Science & Engineering Foundation.

References

- [1] D.H.Ping, K.Hono and S.Hirosawa, J. Appl. Phys., 83 (12), (1998) 7769



Fig.1. Logo of SOMMA conference.