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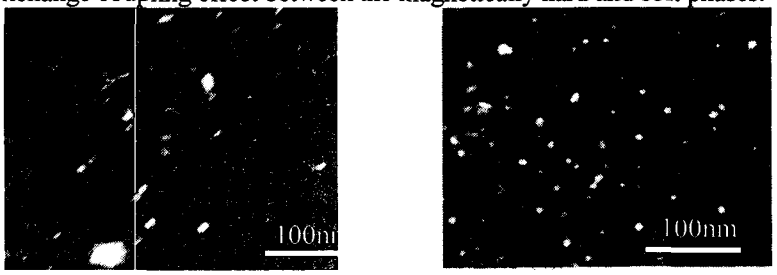
Influence of roll speed on magnetic properties and structure of α-Fe/$Nd_2Fe_{14}B$ nanocomposite magnets prepared by melt-spinning

Wenli Pei[1,2], Fazeng Lian[1], Meng Fu[1], Guiqin Zhou[1]

[1]School of Materials and Metallurgy, Northeastern University, Shenyang, 110004, China
[2]Dept. of Electronic Engineering, graduate School of Engineering, Tohoku University
Aoba-yama 05, Sendai, 980-8579, Japan

Corresponding author: Wenli Pei; e-mail: Wenlipei@ecei.tohoku.ac.jp; wenlipei@sina.com
Phone: 81-22-217-7134, Fax:81-22-263-9402

The crystallization behaviours with different quenching rate (roll speed) of nanocomposite were studied by XRD and DTA. The results show that there was one-step crystallization process for the quenched alloy quenched at roller speed of 32m/s, which may show as, Am+α-Fe+$Nd_2Fe_{14}B$→α-Fe+$Nd_2Fe_{14}B$. For the alloy quenched at roller speed of 40m/s, there was two-step crystallization process to take place at different temperature, which may show as, Am→α-Fe+$Nd_2Fe_{23}B_3$+ $Nd_2Fe_{14}B$+ Am′→α-Fe+$Nd_2Fe_{14}B$ TEM images (Fig.1) show that uniform grain size structure was attained for the as-quenched alloy containing less amorphous phase and no transition phase after being crystallized. For the alloy prepared at roller speed of 32m/s, the following properties can be obtained, Br=0.904T, (BH)max=122kJ/m^3 and Hci=801kA/m. The transition phase ($Nd_2Fe_{23}B_3$) is harmful to get fine and uniform grain size. Avoidance of transition phase can improve magnetic properties by refining the crystalline grain size for reinforcing the exchange coupling effect between the magnetically hard and soft phases.



(a) (b)

Fig.1. TEM image of crystallized samples with different roll speed (a)32m/s (b) 40m/s

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