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Investigation of Nd-Al-Fe Added Nd-Fe-B Alloy Produced by Arc Melting

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Abstract : The scope of this study, to investigate the magnetic properties and microstructure of $Nd_2Fe_{14}B_1$ by alloying with $Nd_{33.4}Fe_{62.6}Al_4$, and heat treating it at different temperatures. The stoichiometric $Nd_2Fe_{14}B$ hard magnetic alloy and $Nd_{33.4}Fe_{62.6}Al_4$ composition was produced by arc melting under argon atmosphere. The $Nd_{33.4}Fe_{62.6}Al_4$ alloy has added to the 2:14:1 hard magnetic alloy with 48% by weight, and melted again by arc melting. Then, it was heat treated at 600, 700 and 800˚C for 3h under vacuum. In AC magnetic susceptibility measurements, for the as-cast sample, the signals decreased sharply at 101 ˚C and 313 ˚C corresponding to the Curie temperatures of the two ferromagnetic phases in addition to Fe phase. For the sample annealed at 600 ˚C, two Curie points were observed at about 257˚C and at 313˚C. However, the phase corresponding to the Curie temperature of 101 ˚C was disappeared. According to the magnetization measurements, the saturation magnetization has the highest value of 99.8 emu/g for the sample annealed at 600 ˚C, and decreased to 57.66 and 28.6 emu/g for the samples annealed at 700˚ and 800 ˚C respectively. Heat treatment resulted in an evolution of the new phase that caused changes in magnetic properties of the alloys. In order to have a clear picture, the identification of these phases are being under the investigation by XRD and SEM–EDX analysis.

Keywords : NdFeB hard magnets, bulk magnetic materials, arc melting, Curie temperature, heat treatment
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