Studi sifat-sifat memagnetan dan analisis kinetika alloy magnet permanent Nd-(Fe,Co)-B

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Abstrak

ABSTRAK
Studi sifat kemagnetan dan analisis kinetika alloy magnetic berbasis Nd-(Fe,Co)-B telah dilakukan. Ingot dan pita-pita alloy magnetic Nd10(Fel-xCox)14B6 (at %) dengan komposisi x = 0 ; 0.1; 0.2 ; dan 0.5 dibuat masing-masing dengan arc melting furnace dan Teknik melt spinning dengan kecepatan substrat 30 m s pita-pita sampel kemudial dianil dengan temperature 700 C selama 2 sampai 120 menit untuk meningkatkan derajat kristalisasi fasa yang terbentuk adalah Nd2(Fe,Co)14B sebagai fasa utama, dan fasa minar alpha-Fe serta Co. studi XD menunjukkan bahwa volume sel satuan fasa utama berkurang dengan peningkatan subsitusi Co. ukuran butir rata-rata fasa utama dievaluasi dengan menggunakan formula Scherrer dan ditemukan bahwa semua butiran berukuran dalam skala nanometer. Pengukuran sifat kemagnetan menggunakan VSM untuk alloy yang dipelajari diketahui bahwa nilai koersivitas masimum 499 kAm diperoleh untuk alloy dengan komposisi x = 0,1 setelah aniling pada temperature at 700 C selama 2 menit Remanen dari semua pita-pita alloy berkisar antara 0.80-1.10 T Peningkatan nilai remanen disebabkan oleh exchange coupling annatar fasa Nd2(Fe,Co)14B dan partikel alpha-Fe yang berukuran ultra halus (nanometer) di dalam alloy Nd-Fe-B dengan kandungan Nd rendah. Produk energi maksimum dari pita alloy yang telah dianil berkisar antara 28-115 kJ m3. Pengukuran temperature Curie, Tc dengan menggunakan differential scanning calorimeter (DSC) dari pita-pita kristalin menunjukkan bahwa terjadi kenaikan nilai Tc dari 304 C untuk alloy x = 0 sampai 650 C untuk alloy x = 0.5. kinetika kristalisasi dari fasa amorf alloy Nd10(Fe1-xCox)84B6 juga telah dianalisis dengan menggunakan DSC. Energi aktivasi Ec dan konstanta Avrami, n untuk kristalisasi alloy dengan komposisis X = 0 dan x = 01 dihitung dengan menggunakan metode Kissinger yang telah dimodifikasi. Hasil-hasil analisis kinetika menunjukkan bahwa transformasi fasa dikontrol oleh proses difusi dengan laju pertumbuhan dan nukleasi konstan.
<hr><i>ABTRACT
Magnetic studies and kinetic analysis on melt spun ribbon of Nd-(Fe,Co)-B based permanent magnets have been done. Ingot and ribbon samples of Nd10(Fel-xCox)14B6 (at %) with x = 0 ; 0.1; 0.2 ; and 0.5 compositions were prepared by arc melting furnace and melt spinning with substrate velocity of 30 mis respectively. The ribbon samples were subsequently annealed at 700 C for 2-120 minutes to promote crystallization. The phases present in the samples are Nd2(Fe,Co)14B type as main phase, alpha-Fe, and Co as the addition. X-ray diffraction studies indicate that the volume of unit cell of main phase tends to decrease by Co substitution. The mean grain size of main phase was also evaluated by line broadening analysis, using the Scherrer formula and found that all the grains were in nanometer scale. From magnetic measurements by VSM for the alloys under studied, it is found that the maximum coercivity of 499 kA per m was observed in the ribbon alloy of x = 0.1 composition after annealing at 700 C for 2 minutes. Remanence of all as-spun and heat treated ribbons are in the range of 0.80 to 1.10 T (above the theoretical value based on Stoner-Wohlfarth theory.L12; Js = saturation magnetization). The enhancement of remanence raised due to

exchange coupling between nanosized Nd2(Fe,Co)14B and cc -Fe particles in the Nd-Fe-B alloys with lower Nd content. Maximum energy products of the annealed ribbon are in the range of 28 to 115 kJ per m3. The Curie temperature, T, measurement of crystallized melt spun ribbon by Differential Scanning Calorimeter (DSC) show an increase the value of L from - 304 C for alloy x = 0 to -650 C for alloy x = 0.5. The kinetic of crystallization process of amorphous Nd1o(Fe1-x Cox)14B6 alloy have also been analyzed by DSC employed modified Kissinger method from which activation energy, Ec and Avrami constant, n for the crystallization were determined for alloys with composition x = 0 and x = 0.1. Results of kinetic analysis show that the phase transformation is a diffusion-controlled transformation with initial growth of particles nucleated at a constant rate.</i>