Evaluasi koersifitas magnet permanen Nd-Fe-B antara efek ukuran partikel dan subtitusi parsial dysprosium terhadap neodymium = Evaluation of Nd-Fe-B permanent magnet coercivity between particle size effects and partial substitution dysprosium with neodymium.

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Abstrak

Telah dilakukan rekayasa struktur material magnet pemanen berbasis fasa Nd2Fe14B melalui subsitusi parsial atom neodymium (Nd) dalam sel satuan dengan atom dysprosium (Dy) sehingga membentuk fasa (Nd,Dy)2Fe14B untuk meningkatkan nilai koersifitas. Rekayasa struktur untuk peningkatan nilai koersifitas dimaksud juga dilakukan melalui pengecilan ukuran partikel fasa (Nd,Dy)2Fe14B dengan memperpanjang durasi waktu penghalusan pada proses penghalusan mekanik. Ingot material dengan tiga komposi berbeda Nd20-xDyxFe14B dengan x = 1, 3, 5 at.% dipersiapkan dengan mini arc melting furnace (AMF) dan dilanjutkan dengan perlakuan anil selama 24 jam untuk homogenisasi mikrostruktur. Sampel magnet untuk masing - masing komposisi diperoleh setelah tahapan-tahapan penghalusan mekanik dengan variasi durasi waktu penghalusan 5, 10, 15 dan 20 jam. Evaluasi nilai koersifitas sampel magnet memperlihatkan peningkatan tajam terjadi karena pembentukan mikrostruktur yang terdiri dari fasa utama (Nd,Dy)2Fe14B dan fasa yang kaya Nd (Nd-rich phase) paska perlakuan panas.

.....A change of the cell structure of the permanent magnet materials based on the Nd2Fe14B phase has been carried out through partial substitution of the neodymium (Nd) atom with the dysprosium (Dy) to form (Nd, Dy)2Fe14B phase to increase the coercivity value. The increase in coercivity has also been achieved by refining the particle size of (Nd, Dy) by mechanical milling with varying times of time. Ingot of Nd20-xDyxFe14B with x = 1, 3, 5 at.% were prepared by mini arc melting furnace (AMF) and successively followed by annealing treatment for 24 hours in a sealed quartz tube for microstructure homogenization. As annealed magnetic ingots for for each composition was then mechanically refined for the duration of grinding times 5, 10, 15 and 20 hours and compacted in a cylindrical die of 12 mm diameter for magnetic sample preparation. The value of coercivity of all magnetic samples was evaluated from the hysteresis loop. It is found that the best improvement of coercivity occurred due to microstructural formation which consisting of the main phase (Nd, Dy)2Fe14B and the Nd rich phase (Nd rich phase) after heat treatment.