Efek anisotropi sistem nano komposit Ba 0.7 Sr 0.3 TIO3 dan Bao0.7Sro.3Fe12O19 terhadap sifat magnetoelektrik = Effect of induced anisotropy to the magneto electric properties of nanocomposites Ba 0.7 Sr 0.3 TIO3 dan Bao0.7Sro.3Fe12O19 / Novizal

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Abstrak

[ABSTRAK
Pada penelitian Disertasi ini telah dilakukan rekayasa material untuk pembuatan nano komposit magnetoelectric yang merupakan material multifungsi dengan menggabungkan antara material berfasa ferromagnetik dan material berfasa ferroelektrik Rekayasa material dilakukan dengan menggunakan metoda mechanical alloying yang dilanjutkan dengan penghalusan secara mekanik dan destruksi ultrasonik daya tinggi untuk mendapatkan ukuran partikel dalam skala nanometer Material nanokomposit dipersiapkan dalam bentuk pellet Komponen komponen komposit baik itu Ba0 7Sr0 3O 6 Fe2O3 B7S3HF dan Ba0 7Sr0 3TiO3 B7S3T mengunakan material nanopartikel yang merupakan hasil subsitusi parsial ion Ba dengan Sr pada senyawa BHF dan BT sehingga meningkatkan volume sel satuan Hasil pengujian X Ray Diffraction XRD menunjukan bahwa sampel yang dihasilkan merupakan material fasa tunggal untuk senyawa Ba0 7Sr0 3O 6 Fe2O3 BSHF dan Ba0 7Sr0 3TiO3 BST Pengujian kemagnetan material dilakukan dengan Permagraph sedangkan sifat elektrik material dilakukan dengan electrometer Hasil pengujian ini menaikkan nilai magnetisasi remanen untuk BSHF dari BHF masing masing adalah 0 180 T dan dan 0 16 T menurunkan nilai koersivitas masing masing adalah 275 54 kA m 1 dan 322 14 kA m 1 Nilai ini sesuai dengan nilai yang dipublikasikan dalam berbagai literatur dan dengan demikian sintesis material berbasis BSHF dan BHF dengan metode yang diterapkan dipastikan menghasilkan material berfasa tungal Demikian juga halnya dengan hasil karakterisasi material BST dengan electrometer diperoleh nilai polarisasi total untuk BaTiO3 dan Ba0 7Sr0 3TiO3 masing masing adalah 42 8 C cm 2 dan 40 7 C cm 2 Hasil pengujian dengan menggunakan Particle Size Analyzer PSA terhadap material komponen komposit menunjukkan ukuran rata rata partikel Ba0 7Sr0 3TiO3 atau B7S3T adalah 78 nm dan Ba0 7Sr0 3O 6 Fe2O3 atau B7S3HF adalah 44 nm yang diperoleh pasca penghalusan mekanik yang dilanjutkan dengan destruksi ultrasonik selama 12 jam Sedangkan sifat kemagnetan material B7S3HF adalah 0 180 T untuk magnetisasi remanen dan 275 54 kA m 1 untuk nilai koersivitas Nilai magnetisasi remanen mengalami peningkatan menjadi 0 249 T karena efek induksi anisotropi oleh medan magnet luar sebesar 5 mT tanpa penurunan nilai koersivitas Dalam bentuk nanokomposit B7S3T B7S3HF dengan komposisi 1 1 dalam fraksi massa diperoleh hasil 0 115 T untuk nilai remanen dan 282 14 kA m 1 untuk nilai koersivitas tanpa induksi anisotropi Nilai magnetisai remanen ini adalah 46 nilai remanen B7S3HF tanpa induksi anisotropi Nilai remanen sampel nanokomposit meningkat menjadi 0 148 T tanpa perubahan nilai koersivitas setelah induksi anisotropi Maka dapat disimpulkan bahwa ada peningkatan sebesar 0 010 T atau 8 berasal dari efek kopling antara kristalit B7S3HF dan B7S3T merupakan salah satu sifat magnetoelektric Hasil inspeksi nilai remanen terhadap material B7S3HF baik dalam jaringan komposit B7S3T B7S3HF memperlihatkan bahwa efek induksi anisotropi telah meningkat nilai magnetisasi remanen serta memperlihatkan munculnya sifat magnetoelektrik dalam sistem komposit;

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ABSTRACT
In this Dissertation research synthesize of magnetoelectric nanocomposite which is multifunctional materials was carried out by combining ferromagnetic and ferroelectric components Nanocomposites were made of barium strontium hexaferrite Ba0 7Sr0 3O 6 Fe2O3 B7S3HF as ferromagnetic and barium strontium titanate dan Ba0 7Sr0 3TiO3 B7S3T as ferroelectric components Materials preparation was carried out trough mechanical alloying route which followed by mechanical refinement and high power ultrasonic destruction to obtain particle sizes in the nanometer scales Nanocomposite materials were prepared in pellet form In this case components of composite which are B7S3T and B7S3HF made of nanoparticles Phase identification by X Ray Diffraction XRD method showed that all samples B7S3T and B7S3HF are respectively single phase materials As to the characterization it was found that partial substitution of Ba ions by Sr ions in BT and BHF has increased the volume of their respective unit cell The magnetic properties of magnetic materials which evaluated by a Permagraph have derived values for remanent magnetization of B7S3HF and BHF were respectively 0 18 T and 0 16 T with their corresponding coercivity 275 54 kA m 1 and 322 14 kA m 1 respectively These values are almost similar to the values published elsewhere for BHF and BT which then confirmed once again that the synthesized BHF and BT based materials material are single phase Similarly results of material characterization for B7S3T with an electrometer has derived total polarization values obtained for BaTiO3 and B7S3T were 42 8 C cm 2 and 40 7 C cm 2 respectively Test results using Particle Size Analyzer PSA of the material components for the composites showed that the mean particle size of Ba0 7Sr0 3TiO3 or B7S3T is 78 nm and that of Ba0 7Sr0 3O 6 Fe2O3 or B7S3HF is 44 nm which were obtained after further refining under mechanical milling followed by high power ultrasonic destruction for 12 hours Whereas the remanent magnetization of B7S3HF is 0 180 T and 275 54 kA m 1 for the coercivity The remanent magnetization value increased to 0 249 T with no changing in the coercivity value after anisotropy induced by an external magnetic field of 5 mT In addition the isotropic B7S3T B7S3HF nanocomposite with a composition 1 1 mass fraction has a remanent magnetization value of 0 115 T with a corresponding coercivity of 282 14 kA m 1 The remanence value of 0 115 T is about 46 of that of an isotropic B7S3HF However the remanent magnetization value for nanocomposite samples increased to 0 148 T with no change in coercivity after induced anisotropy It then can be concluded that there was an increase of 0 010 T or 8 in a remanent value which rose from coupling effects between crystallites of B7S3HF and B7S3T Results of inspection in remanent values for a ferromagnetic B7S3HF material present alone as well as in B7S3T B7S3HF composites showed that the all samples have shown an increased in remanent magnetization values which rose from magneto electric properties , In this Dissertation research synthesize of magnetoelectric nanocomposite which is multifunctional materials was carried out by combining ferromagnetic and ferroelectric components Nanocomposites were made of barium strontium hexaferrite Ba0 7Sr0 3O 6 Fe2O3 B7S3HF as ferromagnetic and barium strontium titanate dan Ba0 7Sr0 3TiO3 B7S3T as ferroelectric components Materials preparation was carried out trough mechanical alloying route which followed by mechanical refinement and high power ultrasonic destruction to obtain particle sizes in the nanometer scales Nanocomposite materials were prepared in pellet form In this case components of composite which are B7S3T and B7S3HF made of nanoparticles Phase identification by X Ray Diffraction XRD method showed that all samples B7S3T and B7S3HF are respectively single phase materials As to the characterization it was found that partial substitution of Ba ions by Sr ions in BT and BHF has increased the volume of their respective unit cell The magnetic properties of magnetic materials which evaluated by a Permagraph have

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