Karakterisasi sifat ferromagnetik dan ferroelektrik material multilayer BaFe12O19/BaTiO3 yang disintesa dengan Metode Sol-Gel/Spin Coating = Study on ferromagnetic and ferroelectric properties of BaFe12O19/BaTiO3 multilayer sintesized by Sol-Gel/Spin Coating Method.

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Abstrak

Penelitian ini bertujuan untuk mensintesa dan mengoptimasi thick film BaFe₁₂O₁₉ fasa tunggal, thick film BaTiO₃ fasa tunggal dan material multilayer BaTiO₃/ BaFe₁₂O₁₉ dengan metode Sol-Gel/Spin Coating. Karakterisasi dilakukan untuk mengetahui sifat ferromagnetik dan ferroelektrik. Deposisi material multilayer dilakukan pada substrat single crystal Si (100) menggunakan spin coater. Thick film BaFe₁₂O₁₉ fasa tunggal berhasil disintesa dengan parameter optimum jumlah lapisan 9 lapis, kecepatan putaran 3000 rpm, temperature annealing 1000⁰C selama 3 jam, dan rasio molar Ba: Fe = 1 : 8. Hasil karakterisasi SEM menunjukkan bahwa material multilayer BaFe₁₂O₁₉memiliki distribusi ukuran dan bentuk partikel yang homogen, dengan ukuran partikel berkisar antara 100-150 nm dan tebal sekitar 2,9 µm. Hasil uji VSM pada material multilayer BaFe₁₂O₁₉menunjukkan nilai koersivitas pada arah parallel dan perpendicular yang hampir sama yaitu 2,5 kOe. Thick film BaTiO₃ fasa tunggal berhasil dideposisikan dengan kondisi proses optimum yaitu, temperatur annealing 800⁰C selama 4 jam dan kecepatan putaran 4000 rpm. Film BaTiO₃dengan jumlah lapisan 5 lapis mempunyai ketebalan 2,6-3,2 µm. Material multilayer BaTiO₃/ BaFe₁₂O₁₉ berhasil dideposisikan pada substrat Si dengan metode sol-gel/spin coating serta menunjukkan sifat ferromagnetik dan ferroelektrik. Nilai magnetik Saturasi, Remanen, dan medan koersif pada material multilayer BaTiO₃/ BaFe₁₂O₁₉ yaitu 2,7 memu, 1,3 memu dan 1,7 kOe. Sedangkan kurva histerisis elektrik menunjukkan nilai polarisasi spontan (P_s), polarisasi remanen (P_r) dan medan Coersive (E_c) berturut-turut 5,4 mC/cm², 6,2 mC/cm² dan 1 kV/cm.

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In this research, single phase thick film BaFe₁₂O₁₉, BaTiO₃and BaTiO₃/ BaFe₁₂O₁₉multilayer had been synthesized by sol gel/spin coating method. Ferroelectric and ferromagnetic properties were observed. Multilayer materials was deposited on single crystal substrate Si (100) using a spin coater. Single phase thick film BaFe₁₂O₁₉ was synthesized with optimum parameters of 9 layers, 3000 rpm rotation speed, 1000⁰C annealing temperature for 3 hours, and molar ratio Ba:Fe = 1: 8. The characteristic SEM images indicate that the multilayer BaFe₁₂O₁₉ material has a homogeneous size and shape distribution of particles, with crystallite size 100-150 nm. The magnetic

hysteresis loops for single phase thick film BaFe₁₂O₁₉showed that perpendicular and in-plane coercivity had the same value of 2,5 kOe. Single phase thick film BaTiO₃ was successfully deposited with optimum process conditions which were annealing temperature at 800⁰C for 4 hours and rotation speed 4000 rpm. The BaTiO₃ film with 5 layers has a thickness of 2.6-3.2 µm. BaTiO₃/ BaFe₁₂O₁₉multilayer material was successfully deposited on the Si substrate with the sol-gel/spin coating method and showed ferromagnetic and ferroelectric properties. The saturation magnetization (Ms), remanent magnetization (Mr), and coercivity of BaTiO₃/ BaFe₁₂O₁₉multilayer material are 2.7 memu, 1.3 memu and 1.7 kOe. From ferroelectric hysteresis loop it can be inferred that the values of remanent polarization (Pr), spontaneous polarization (Ps) and coercive field (Ec) are ,4 mC/cm², 6.2 mC/cm² and 1kV/cm, respectively.