

Pembuatan dan karakterisasi $\text{Bi}_{1-x}\text{Y}_x\text{FeO}_3/\text{C}$, $\text{BiFe}_{1-y}\text{ZnyO}_3/\text{C}$, dan $\text{Bi}_{0.88}\text{Y}_{0.12}\text{Fe}_{1-y}\text{ZnyO}_3/\text{C}$ sebagai absorber gelombang mikro pada frekuensi x band = Synthesis and characterization of $\text{Bi}_{1-x}\text{Y}_x\text{FeO}_3/\text{C}$, $\text{BiFe}_{1-y}\text{ZnyO}_3/\text{C}$, and $\text{Bi}_{0.88}\text{Y}_{0.12}\text{Fe}_{1-y}\text{ZnyO}_3/\text{C}$ as microwave absorber at the x-band frequency

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Abstrak

Bahan yang memiliki sifat ferroelektrik dan ferromagnetik berpotensi sebagai absorber gelombang mikro dan memiliki peranan penting pada dunia militer. BiFeO_3 merupakan salah satu bahan multiferroik yang memiliki sifat ferroelektrik dan ferromagnetik. Pada penelitian ini dilakukan rekayasa sintesa BiFeO_3 dengan doping Yttrium dan Seng dengan variasi konsentrasi (% wt) 6, 12, dan 18%. Sintesa BiFeO_3 telah berhasil disintesis dengan metode sol-gel autocombustion. Melalui uji XRD, fasa BiFeO_3 diperoleh pada temperatur 750°C selama 5 jam. Hasil refinement menunjukkan bahwa BiFeO_3 memiliki struktur kristal rhombohedral space grup $R3c$. BiFeO_3 doping Yttrium dan Seng di atas 12% (% wt) terjadi perubahan struktur kristal dari rhombohedral ke orthorhombic. Kurva hysteresis menunjukkan bahwa BiFeO_3 memiliki saturasi magnetik 3.04 emu/g, remanen magnetik 0.26 emu/g, dan medan koersivitas 0.0013 T. BiFeO_3 doping Yttrium dengan konsentrasi (% wt) 12% terjadi peningkatan nilai saturasi magnetik, remanen magnetik, dan medan koersivitas namun BiFeO_3 doping Seng dengan konsentrasi (% wt) 12% terjadi penurunan nilai saturasi magnetik, remanen magnetik, dan medan koersivitas. BiFeO_3 doping Yttrium 12% (% wt) dan Seng 12% (% wt) memiliki nilai saturasi magnetik 8.18 emu/g, remanen magnetik 2.92 emu/g, medan koersivitas 0.0036 T. Pada frekuensi 1 kHz BiFeO_3 memiliki konstanta dielektrik sebesar 239.12 dan adanya doping Yttrium dan Seng terjadi penurunan nilai konstanta dielektrik. Hasil pengujian sifat penyerapan gelombang mikro pada frekuensi X band (8.2 ? 12.4 GHz) diperoleh bahwa bahan $\text{Bi}_{0.88}\text{Y}_{0.12}\text{FeO}_3/\text{C}$ memiliki refleksi loss -39.42 dB pada frekuensi resonansi 11.47 GHz. Dengan demikian bahan $\text{Bi}_{0.88}\text{Y}_{0.12}\text{FeO}_3/\text{C}$ dapat dijadikan bahan penyerap gelombang mikro pada frekuensi X band.

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Materials with both ferroelectric and ferromagnetic properties are potential candidate for microwave absorbers and play important role in military world. One of them is BiFeO_3 , a multiferroic material with both ferroelectric and ferromagnetic properties. In this research, BiFeO_3 has been synthesized successfully via auto-combustion sol-gel method. To improve its properties, yttrium- and zinc-doped BiFeO_3 has been synthesized with various doping concentrations, i.e. 6, 12, and 18 wt.%. X-ray diffraction patterns showed that BiFeO_3 phase was obtained after heating at 750°C for 5 hours with rhombohedral crystal structure and space group of $R3c$. The hysteresis curve of BiFeO_3 showed a magnetic saturation of 3.04 emu/g, magnetic remnant 0.26 emu/g and coercive field 0.0013 T. Yttrium- and zinc-doped BiFeO_3 over 12wt.% showed a structural change from rhombohedral to orthorhombic with magnetic saturation of 8.18 emu/g, the magnetic remnant of 2.92 emu/g and coercive field of 0.0036 T. Yttrium-doped BiFeO_3 showed an increase in the magnetic saturation, the magnetic remnant and the coercive field; however zinc-doped BiFeO_3 showed a decrease in the magnetic saturation, the magnetic remnant and coercive field. At a frequency of 1 kHz, the

dielectric constant of BiFeO₃ was 239.12, and this value will decrease when it was doped by yttrium and zinc. Further investigation on the application of this material, composites Bi_{0.88}Y_{0.12}FeO₃/C has also been synthesized. The composites showed a reflection loss of -39.32 dB within the frequency range of 8.2-12.4 GHz (X-band) particularly at the frequency of 11.47 GHz with the absorptivity of 98.60%. Based on this results, composite Bi_{0.88}Y_{0.12}FeO₃/C material could be used as a potential microwave absorber in the X-band frequency.