Sintesis material polimer konduktif polianilin pani protonasi asam perklorat (HCLO4) dan karakterisasi komposit microwave absorber berpenguat nanopartikel Ba1-xsrxtio3 (x: 0.3; 0.4; 0.7) = Synthetized conductive polyaniline by percchlorate acid protonation and characterization composite of microwave absorber reinforced Ba1-xsrxtio3 (x: 0.3; 0.4; 0.7) nanoparticles / Okti Mulyani

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Abstrak

ABSTRAK
Material dielektrik telah terbukti menguasai perindustrian devais elektronik seiring pesatnya perkembangan teknologi material berbasis nanostruktrur yang memiliki berbagai fungsi kerja termasuk merespon pengaruh gelombang elektromagnetik. Salah satu aplikasi material dielektrik adalah sebagai material penyerap gelombang RADAR atau Radar Absorbing Material RAM . Material dengan senyawa BaTiO3 atau Barium Stronsium Titanat BST memiliki potensial untuk menyerap gelombang elektromagnetik termasuk gelombang RADAR. Dengan demikian, material berbasis BST dapat berperan sebagai penguat filler pada sistem komposit. Pada penelitian ini telah dilakukan sintesis material nanokomposit melalui sintesis conductive polyaniline atau PANi konduktif sebagai matrik yang ditelusuri melalui proses polimerisasi dan sintesis material penguat berbasis BST yang memiliki nanostruktur melalui tahapan pemaduan mekanik mechanical alloying dilanjutkan dengan destruksi partikel secara ultrasonic. Kedua jenis material hasil sintesis ini adalah yang digunakan untuk membuat nanokomposit sistem PANi-BST. Material dielektrik yang menjadi material penguat dipilih memiliki komposisi Ba1-xSrxTiO3 x = 0.3, 0.4 dan 0.7 agar dihasilkan material penguat dengan kontanta dielektrik berbeda. Hasil sintesis PANi melalui polimerisasi menunjukkan bahwa PANi konduktif diperoleh setelah protonasi dengan perchlorate acid HCLO4 berfungsi sebagai dopan. Konduktivitas listrik yang dihasilkan meningkat seiring dengan meningkatnya konsentrasi dopan. Nilai konduktivitas listrik s terendah dan tertinggi yang diperoleh masing-masing adalah 0,72 mS/cm an 5,6 mS/cm. Ketiga BST dengan masing-masing komposisi dikompositkan dengan matriks PANi yang memiliki nilai konduktivitas listrik yang relatif rendah 0,72 mS/cm dan relatif tinggi 5,6 mS/cm tersebut. Komposit bermatrik PANi konduktivitas rendah dan material penguat BST dibuat dengan 3 komposisi berbeda. Demikian juga komposit bermatrik PANi konduktifitas relatif tinggi. Karakterisasi absorpsi terhadap gelombang elektromagnetik terhadap nanokomposit dilakukan menggunakan Vector Network Analyzer VNA . Hasil karakterisasi menunjukkan bahwa nilai Reflection Loss atau RL tertinggi diperoleh dari komposit PANi s = 5,6 mS/cm -BST x = 0,4 dengan komposisi 1:1 massa sebesar -20 dB atau 90 intensitas gelombang mikro diserap pada frekuensi 8,25 GHz dan ndash; 4 dB pada rentang frekuensi 8,5-12 GHz. BST dengan komposisi x = 0,4 memiliki nilai permitivitas listrik tertinggi sebesar 50. Hasil penelitian ini menyimpulkan bahwa kandidat komposit penyerap gelombang terbaik dapat diperoleh dari matrik dengan konduktivitas listrik tinggi dan material penguat BST yang memiliki nilai permitivitas listrik imajiner yang tingi terutama pada rentang frekuensi dibawah 8,25 GHz.
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ABSTRACT

Dielectric materials have found a full range application as electronic devices in many electronic industries as the consequence of rapid development of technology nanostructured based materials. The materials have a variety of functional, including responding to the influence of electromagnetic waves. One of the applications of the dielectric materials is electromagnetic wave absorption, including radar absorbing waves or the so called radar absorbing material RAM . BaTiO3 or Barium Strontium Titanate BST has the potential to absorb electromagnetic waves including the waves of RADAR. Thus, the BST based material would be a suitable filler component in a composite system. In the current study, the synthesis of nanocomposite material was prepared by the use of conductive polyaniline or conductive PANi that synthesized through the polymerization process as a matrix, and the use of nanostructured based BST prepared as the reinforces component which prepared through a mechanical alloying process followed by ultrasonic destruction of particles. Both types of synthesized materials were applied to prepare the PANi BST nanocomposite system. Reinforce materials of Ba1 xSrxTiO3 x 0.3, 0.4 and 0.7 compositions with different dielectric constants were used for composites.Synthesized PANi through polymerization showed that the conductive PANi was obtained after protonation with perchlorate acid HClO4 which acting as a doping agent. Results showed that the electrical conductivity, s of PANi was increased with the increase of dopant concentration. It was found that the lowest value for s was 0.72 mS cm and that of the highest was 5.6 mS cm. BST of each composition was mixed with conductive PANi of respectively having low 0,72 mS cm and high 5,6 mS cm . Matrix of low conductivity was combined with nanoparticles of BST for fabrication of nanocomposite with three different compositions. The nanocomposites of matrix with high conductivity were also fabricated in the same way. Microwave characterization of the composites under studied was carried out by means of Vector Network Analyzer VNA . The results showed that the highest reflection loss or the highest RL value was obtained from composite made of PANi with the high conductivity 5.6 mS cm and BST x 0.4 filler with the composition of 1 1 by mass . For this particular composite, RL value of 20 dB or 90 intensity of wave microwaves was absorbed at a frequency 8.25 GHz and 4 dB in the frequency range 8.5 to 12 GHz. It was also found that BST with composition x 0.4 has the highest electrical permittivity value of 50. The results of this study concluded that the best candidate for microwave absorber can be obtained from the matrix with high electrical conductivity and high imaginary electric permittivity of reinforcing materials lead to high RL value primarily in the frequency range below 8.25 GHz.