Pengaruh subtitusi mn pada material CuFe204 terhadap perubahan fasa material dan karakteristik magnetik serta nilai impedansi = Magnetic characteristics impedance and phase transformation of Mn substituted Mn1 xCuxFe2o4 (x: 0. 25 ; 0.3; 0, 4; 0. 5; 075) materials

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Abstrak

Penelitian ini membahas perubahan fasa dan karakterisasi material ferrite beads sebagai material penyerap gelombang elektromagnetik berbahan dasar Cupropinnel (CuFe2O4) pasca substitusi ion Mn terhadap ion Cu membentuk senyawa dengan komposisi Mn1-xCuxFe2O4 dimana x bernilai 0,25; 0,3; 0,4; 0,5; 0,75 dan MnCuFeO4. Preparasi material menggunakan metode paduan mekanik selama 30 jam diikuti dengan sintering pada dua suhu berbeda masing-masing 1100°C dan 1250°C untuk pembentukan fasa kristalin material. Pengujian XRD menunjukkan fasa yang didapat merupakan material banyak fasa (multiphase) dimana fasa dominannya merupakan fasa ferrite (Fe3O4) tetapi dengan perubahan dimensi kristal karena efek subsitusi. Berdasarkan hasil pengukuran magnetisasi didapatkan bahwa material cupropinnel komposisi Mn1-xCuxFe2O4 ini merupakan material soft ferrite dimana nilai magnetisaasi saturasi meningkat dengan bertambahnya fraksi ion Mn dan mencapai nilai paling tinggi sebesar 0.47 T diperoleh dari MnFe2O4. Nilai impedansi material Mn1-xCuxFe2O4 memiliki nilai tertinggi sebesar 1122 ohm yaitu terajadi pada frekuensi 400 MHz diperoleh dari komposisi Mn0.25Cu0.75Fe2O4. Keseluruhan material memiliki kemampuan menyerap gelombang elektromagnetik terutama pada jangkauan frekuensi 100-500 MHz dengan nilai reflection loss sampel material MnCuFeO4 memberikan nilai yang paling optimal yaitu sebesar 17.86 dB atau 80,34% intensitas gelombang elektromagnetik dapat diserap serapan pada frekuensi optimal 600 MHz, dan lebar pita penyerapan sebesar 250 MHz.

.....In this study, the phase transformation and results of material’s characterization for ferrite beads as electromagnetic wave absorbing materials based on Cupropinnel (CuFe2O4) after substitution of Mn ions in Mn1-xCuxFe2O4 materials are discussed. Materials preparation was carried out by mechanical alloying method for 30 hours and followed by a sintering at two different temperatures, respectively 11000 C and 1250 °C and has led to the formation of the crystalline phase material. Careful identification of diffracted peaks for respective XRD diffraction traces indicated that most of materials under investigation were multi-phase materials in which the main phase matched with that of magnetite phase (Fe3O4) but with a slight change in unit cell dimension due to substitution effects. Based on results of magnetization measurements, it is shown that cupropinnel materials with Mn1-xCuxFe2O4 composition are soft magnetic materials in which the total magnetization value increased with the increase of ionic fraction of Mn, and reached the highest value of 0.47 T obtained from MnFe2O4. The highest value for Impedance in Mn1-xCuxFe2O4 was 1122 ohms at a frequency of 400 MHz which was obtained from the Mn0.25Cu0.75Fe2O4 composition . It was found that all materials have the ability to absorb electromagnetic waves, especially in the frequency range 100-1000 MHz with a largest value of reflection loss for MnCuFeO4 sample was 17.86 dB. It means that about 80.34% of electromagnetic waves intensity can be absorbed by the material at the optimum frequency of 600 MHz the absorption band width for the material was 250 MHz.