Analisis parameter kristal dan karakterisasi serapan gelombang mikro sistem material La1-xBaxMn1-yTiyO3 (x=0+1, y=0+1) = Analysis of crystal parameters and microwave absorbtion characteristics of La1-xBaxMn1-yTiyO3 (x=0+1, y=0+1)

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Abstrak

Penelitian ini membahas mengenai parameter kristal, sifat magnetik, serta karakteristik serapan gelombang mikro pada material komposisi La1-xBaxMn1-yTiyO3 (x = 0 1 dan y = 0 ÷ 1). Digunakan metode mechanical alloying untuk membuat material tersebut yaitu digerus secara mekanik selama 20 - 30 jam, kemudian menjalani perlakuan sintering pada temperatur 1100 0C selama 16 jam untuk memastikan terbentuknya material dengan fasa kristalin. Telah dilakukan 3 karakterisasi material meliputi pengujian XRD (X-Ray Diffractometer) untuk mengetahui fasa dalam material dan sistem kristalnya, pengujian permagraf untuk mengetahui sifat kemagnetan, dan pengujian VNA (Vector Network Analizer) untuk mengetahui karakterisasi serapan gelombang mikro. Diketahui bahwa subsitusi ion Ba terhadap ion La pada pembentukan senyawa La1-xBaxMnO3 menghasilkan material fasa tunggal dengan struktur kristal monoklinik dan material bersifat ferromagnetik. Selanjutnya, subsitusi ion Ti terhadap ion Mn pada senyawa La0.8Ba0.2Mn1-yTiyO3 dan LaMn1-yTiyO3 telah menyebabkan perubahan fasa material menjadi fasa tunggal dengan struktur kristal ortorombik dan monoklinik. Namun, pada subsitusi ion La oleh Ba dan ion Mn oleh Ti pada senyawa La1-xBaxMn1-yTiyO3 (x = 0 1 dan y = 0 ÷ 1) diketahui bahwa terdapat batas solubilitas untuk mensubtitusi ion La dan Mn. Bila batas tersebut terlampaui maka muncul fasa baru sebagai fasa tambahan. Selanjutnya, subsitusi ion Ba menyebabkan material bersifat feromagnetik, sedangkan subsitusi ion Ti, terjadi perubahan sifat magnetik dari feromagnetik menjadi paramagnetik. Hasil karakterisasi serapan gelombang mikro terhadap sampel dengan diameter 25 mm dan ketebalan 2 mm memastikan bahwa keseluruhan material dengan komposisi La1-xBaxMn1-yTiyO3 (x = 0 1 dan y = 0 ÷ 1) memiliki kemampuan menyerap gelombang mikro pada jangkau frekuensi 9-13 GHz. Diperlihatkan bahwa sample dengan komposisi LaMn0,8Ti0,2O3 memiliki nilai returnoss (RL) terbesar yaitu 8,2 dB pada frekuensi 10,8 GHz dengan lebar frekuensi sebesar 1,62 GHz.

.....The crystal parameters, magnetic properties and microwave absorption characteristics of ionic substituted lanthanum manganese based materials of La1-xBaxMn1-yTiyO3 (x = 0 ÷ 1 and y = 0 ÷ 1) compositions are reported. Each material was designated with specific composition that prepared through mechanical alloying method. They all material components were mechanically milled during 20 to 30 hours in a planetary ball milling apparatus to obtain highly deformed powders. Then the powders were treatly heated at sintering temperature around 1100 0C around 16 hours. This treatment ensured getting the material with perfect crystalline phases. Each the crystalline sample was evaluated by three different characterization methods. First, XRD (X-Ray Diffractometer) measurement to identify phases and crystal systems in sample materials. Second, permagraph measurement to determine the magnetic properties. Third, characterization of microwave absorption by means of a vector network analyzer or VNA. It was found that substitution of Ba ion onto the La ions in the formation of La1-xBaxMnO3 materials has produced single phase material with a monoclinic crystal structure and the material is a ferromagnetic order. Furthermore, substitution of Ti ion

onto the Mn ions in the formation of La0.8Ba0.2Mn1-yTiyO3 has caused a phase changing in which the crystal structure of monoclinic changed to orthorhombic while the material was remain a single phase. On the other hands, LaMn1-yTiyO3 still remains as monoclinic structure. However, on substitution of La ions by Ba and Mn ions by Ti in the La1-xBaxMn1-yTiyO3 materials, a solubility limit both for La and Mn ions was observed. When the limit was exceeded, the new phase appeared as an additional phase in the material. In addition, the substitution of Ba ions has caused the material to be ferromagnetic order, while the Ti substitution to Mn ions, a change in the magnetic properties of ferromagnetic to paramagnetic was also observed. Results of microwave absorption characterization in the samples of a typical diameter of 25 mm and 2 mm thickness have shown that all La1-xBaxMn1- yTiyO3 ($x = 0 \div 1$ and $y = 0 \div 1$) materials have the ability for absorbing the microwave in a frequency range of 9-13 GHz. It is shown that the LaMn0,8Ti0,2O3 sample has the largest return loss (RL) value of 8.2 dB at a frequency 10,8 GHz and with of the absorption width of 1.62 GHz.