Sintesa dan struktur kristal keramik garnet Y3 Fe5-5X AI5x O12

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Abstrak

The effect of Fe substitution on AI of garnet ceramic with chemical formula Y3Fe5_5XAl5 O12, where x (synthesis) of 0, 0.05, 0.15, and 0.25, has been investigated. Sample in this study were synthesized using wet oxydation method, Hot Kerosene Drying (HKD). All constituents were used in liquid form from YCI3.6H2O, AIC13, and Fe2O3 and HCI, which were reagents with purity better than 99%. Thermal 'analysis (DTA) was used to investigate calcination and sintering temperature. The resultant powders were calcined at 1250°C and sintered 1350°C and 1400°C. The X-ray diffractogram, which were obtained at room temperature, were refined using crystallographic software package GSAS. The samples contain at least 85% garnet phase with the remaining Fe2O3 impurity phase. In those garnet phases, 0 atom slightly shift. As a concentration increases theoretical densities decreases. For increasing x (synthesis) above, the theoretical densities and unit cell volume, respectively are of 5.148 grlcm3, 4.951 grlcm3, 4.946 grlcm3, 4.918 grlcm3 and 1.890x10-21 cm3, 1.885x10' 1 cm3, 1.874x10-2i cm3, 1.856x10-21 cm3 for the sample sintered at 1350°C. Similarly, at 1400°C, the theoretical densities and unit cell volume, respectively, are of 5.136 grlcm3, 5.100 grlcm3, 5.021 grlcm3, and 1.891x10-21 cm3 1.885 x10-21 cm3 1.875x10-21 cm3 without x (synthesis) of 0.25 . The formula of resultant garnets, respectively, are of Y3Fe4.88O12, Y3Fe3.77A11.23012, Y3Fe3.61A11,39012, and Y3Fe3.25Al1.7512 for the samples sintered at 1350°C. Similarly, at 1400°C, The formula of resultant garnets, respectively, are of Y3Fe4.33O12, Y3Fe4.51A10.89O12, Y3Fe3A12O12. Based on macroscopic measurements, the average bulk density and porosity respectively, are of 3.458 grlcm3 and 27.32%, which confirms the X-ray diffraction (microscopic) measurement.

<hr>Telah dilakukan penelitian terhadap keramik garnet dengan rumus kimia Y3Fes-5 AI5xO12. Nilai sintesis x adalah 0; 0,05; 0,15 dan 0,25. Sintesa dilakukan dengan metoda oksidasi basah, yaitu Hot Kerosene Drying (HKD). Bahan dasar yang digunakan adalah YCI3.6H20, AICI3, Fe203, dan HCl dengan kemurnian diatas ± 99%. Setelah sintesa dilakukan analisa termal (DTA) untuk mengetahui temperatur kalsinasi dan temperatur sintering: Sampel dikalsinasi pada pada temperatur 1250°C dan disintering pada temperatur 1350°C dan 1400°C. Analisa difraksi dilakukan pada masing-masing sampel dan diolah dengan perangkat lunak GSAS. Didapatkan persentase garnet yang terbentuk diatas 85% untuk seluruh sampel, dengan fasa pengotor adalah Fe203. Posisi atom-atom penyusun garnet hasil sampel yang disintesa menunjukkan tidak ada perubahan, kecuali pada atom 0 ada sedikit pergeseran posisi atom. Densitas teoritis menurun dengan semakin tingginya konsentrasi Al pada garnet. Dari harga nominal x diatas didapatkan densitas teoritis dan volume per unit selnya berturut-turut: 5,148 gr/cm3, 4,951 gr/cm3, 4,946 grlcm3, 4,918 gr/cm3 dan 1,890x10-1 cm3, 1,885x10-21 cm3, 1,874x10-1 cm", 1,856x10'21 cm3 untuk temperatur sintering 1350°C serta 5,136 Tice, 5,100 grlcm3, 5,021 grlcm3, dan 1,891x10-21 cm3, 1,885 x10'21 cm3, 1,875x10-1 cm3 untuk temperatur 1400°C (tanpa nilai sintesis x=0,25). Sedangkan rumus kimia garnet yang terbentuk berturut-turut adalah Y3Fe4,88012, Y3Fe3.77A11.23012, Y3Fe3.61A1i.39012, Y3Fe3.25A11.75012 untuk temperatur sintering 1350°C dan Y3Fe4888012, Y3Fe4.51AI0.89012,

Y3Fe3A12O12 untuk temperatur sintering 1400°C. Dihitung pula secara makroskopik densitas bulk dan porositas, dengan harga rata-rata 3,458 grlcm3 untuk densitas bulk serta 27,32% untuk porositas.