Pengaruh ukuran partikel, komposisi YTTRIA, dan suhu sintering terhadap karakteristik elektrolit zirconia

Ruslan Effendi, author

Abstrak

Telah diiakukan pembuatan keramik stabilized ZrO2 dengan aditif Y203 menggunakan metoda kopresipitasi dan variasi Y203 7%, 9%, dan 11% mole. Endapan yang dihasilkan dikalsinasi pada suhu 500 °C. Dua ukuran partikel yaitu 0,5 gm dan 5 µm yang diperoleh dari hasil kalsinasi dicetak dengan tekanan 5 ton, dan disintering pada suhu : 1100 °C, 1200 °C, 1300 °C, dan 1400 °C selama 2 jam. Hasil sintering dikarakterisasi meliputi : sifat fisis (densitas, porositas, hardness, toughness, koef. ekspansi thermal), konduktivitas listrik, dan struktur mikro.

Hasil karakterisasi menunjukkan bahwa komposisi Y203 kurang berpengaruh terhadap sifat fisis maupun struktur mikro, tetapi hanya sedikit berpengaruh terhadap konduktivitas listrik, dimana 7 % Y203 pada suhu 1400 °C mempunyai nilai tertinggi dengan energi aktivasi terendah. Suhu sintering berpengaruh besar terhadap sifat fisislelektrik dan struktur mikro, tetapi tidak berpengaruh terhadap fasa yang terbentuk. Ukuran partikel berpengaruh besar terhadap sifat fisislelektrik dan struktur mikro, dimana sampel dengan ukuran partikel 0,5 i.m pada suhu 1400 °C telah mencapai densifikasi yang baik.

Hasil karakterisasi pada suhu 1400 °C dan dari berbagai komposisi Y203 mempunyai karakteristik sebagai berikut : sampel 0,5 µm adalah : densifikasi (93 - 95) %, porositas < 2 %, hardness Vickers = 13 -15 Gpa, toughness = 2.5 MPa 11m, konduktivitas listrik pada 1000 °C = 0.1 (Ohm cm) -', dan koef. ekspansi thermal = 16 - 20 x 10 -61°C . Sampel 5 µm adalah : densifikasi 83 - 84%, . porositas = (14 - 17)%, hardness Vickers = (10 - 12) Gpa, toughness = (1.7 - 1.9) MPa gym, konduktivitas listrik < 0.01 (Ohm cm) ^', dan koef. ekspansi thermal = 15 - 18 x 10 -61°C.

.....Stabilized Zr02 ceramic was made with Y2O3 additive, by using coprecipitation method. The Y2O3 variation was 7%, 9%, and 11% mole. The produced precipitate was calcined at 500 °C. Two kinds of particle size i.e 0,5 p.m and 5 gm which were obtained from calcination were pelletized under 5 ton pressure and then sintered at temperature : 1100 °C, 1200 °C, 1300 °C, and 1400 °C for 2 hours. Sintered pellets were caracterized : physical properties (density, porosity, hardness, toughness, coef. of thermal expansion), electrical conductivity, and microstructure.

The result of caracterization showed that Y2O3 composition was not influenced to physical properties as well as microstructure. However, composition gave a little effect toward electrical conductivity, in which 7% Y2O3 gave highest value and lowest activation energy. Sintering temperature influenced greatly to physical and electrical properties as well as its microstructure, but it did not influence to crystal phase. Particle sizes influenced greatly to physical and electrical properties as well as its microstructure, in which sample having 0,5 pm at 1400 °C has reached good densification.

The result of characterization at 1400 °C under various composition of Y2O3 as follows : Samples 0,5 p.m have properties : densification = (93 - 95) °%, porosity < 2%, hardness Vickers = (13 - 15) Gpa, toughness = 2.5 MPa ,Tr-n, electrical conductivity at 1000 °C = 0.1 (Ohm cm) and coef. of thermal expansion = (16 - 20) x 10 -61 °C. Samples 5 p.m have properties : densification = (83 - 84) %, porosity = (14 -17)-%, hardness

Vickers = (10 - 12) Gpa, toughness = (1.7 - 1.9) MPa electrical conductivity at 100 °C < 0.01 (Ohm cm) -', and coef. of thermal expansion = (15 -18) x 10 -61 °C.