

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

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Abstrak

Telah dilakukan pembuatan keramik stabilized ZrO₂ dengan aditif Y₂O₃ menggunakan metoda kopresipitasi dan variasi Y₂O₃ 7%, 9%, dan 11% mole. Endapan yang dihasilkan dikalsinasi pada suhu 500 °C. Dua ukuran partikel yaitu 0,5 µm 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 Y₂O₃ kurang berpengaruh terhadap sifat fisis maupun struktur mikro, tetapi hanya sedikit berpengaruh terhadap konduktivitas listrik, dimana 7 % Y₂O₃ pada suhu 1400 °C mempunyai nilai tertinggi dengan energi aktivasi terendah. Suhu sintering berpengaruh besar terhadap sifat fisislektrik dan struktur mikro, tetapi tidak berpengaruh terhadap fasa yang terbentuk.

Ukuran partikel berpengaruh besar terhadap sifat fisislektrik dan struktur mikro, dimana sampel dengan ukuran partikel 0,5 µm pada suhu 1400 °C telah mencapai densifikasi yang baik.

Hasil karakterisasi pada suhu 1400 °C dan dari berbagai komposisi Y₂O₃ 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) ⁻¹, dan koef. ekspansi thermal = 16 - 20 x 10 ⁻⁶ /°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) ⁻¹, dan koef. ekspansi thermal = 15 - 18 x 10 ⁻⁶ /°C.

.....Stabilized ZrO₂ 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 µm and 5 µm 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 characterized : physical properties (density, porosity, hardness, toughness, coef. of thermal expansion), electrical conductivity, and microstructure.

The result of characterization 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 µm at 1400 °C has reached good densification.

The result of characterization at 1400 °C under various composition of Y₂O₃ as follows : Samples 0,5 µm 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 ⁻⁶ /°C. Samples 5 µm 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)⁻¹,
and coef. of thermal expansion = (15 -18) x 10⁻⁶ °C.