Pengaruh waktu tahan terhadap karakteristik ceramic matric composites (CMCs) ZrO2/Al produk directed metal oxidation - dimox = Effect of holding time on characteristics of Zro2/Al ceramic matrix composites (cmcs) produced by directed metal oxidation (DimoxTM)

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Abstrak

Untuk memenuhi kebutuhan akan material yang memiliki sifat canggih, saat ini Ceramic Matrix Composites (CMCs) sedang terus dikembangkan. CMCs merupakan material komposit dengan potensi untuk berbagai jenis aplikasi karena sifatnya yang memiliki kekuatan, kekakuan, dan ketahanan terhadap creep yang sangat baik, namun cenderung bersifat getas. Penelitian ini mencoba menggabungkan material keramik ZrO2 yang memiliki kombinasi yang prima dari kekuatan dan ketangguhan yang cukup baik serta stabilitas pada temperatur tinggi dengan material logam aluminium yang memiliki sifat ringan, dan ketangguhan yang tinggi. Penelitian CMCs ZrO2/Al ini menggunakan proses Directed Metal Oxidation (DIMOXTM), dan bertujuan untuk mempelajari pengaruh dari waktu tahan. Temperatur proses yang digunakan yaitu 1200_C untuk variasi waktu tahan, mulai dari 8, 10, 15, 20 hingga 24 jam, dengan 10% Mg sebagai dopant. Karakterisasi terhadap produk CMCs yaitu dengan mengukur pertambahan massa, pengujian densitas & porositas, kekerasan mikro, laju keausan, dan pengamatan struktur mikro dengan menggunakan mikroskop optik dan SEM serta pengujian komposisi kimia menggunakan EDS. Hasil penelitian menunjukkan bahwa semakin lama waktu tahan firing, terjadi kenaikan pertambahan massa, porositas, dan kekerasan, sebaliknya terjadi penurunan densitas dan laju aus. Produk CMCs optimum diperoleh dengan waktu tahan firing 24 jam dengan pertambahan massa 25,75 gr, densitas 3,16 gr/cm3, porositas 7,7%, kekerasan mikro 1188 VHN dan laju aus sebesar 19,09 mm3/mm x 10-7. Fasa-fasa yang terbentuk dari produk CMCs diantaranya adalah Al2O3, spinel (MgAl2O4) dan ZrO2.

<hr><i>To fulfill the needs of ever increasing demand on advanced materials, Ceramic Matrix Composites (CMCs) is being developed progressively. CMCs is a composite material with rigorous potential to various application attributable to its properties, which includes good strength, stiffness and creep resistant. Yet, most of study results revealed that CMCs tend to be brittle. This research aim is to make CMCs materials by combining ZrO2 ceramic, which have an excellent combination of good strength, enough toughness and high temperature stability, with alumunium, which are light in weight and have high toughness. By using Directed Metal Oxidation (DIMOXTM) process, this study observed and measured the effect of holding time on ZrO2/Al. The proposed composite material speciments were heated at 1200_C for 8, 10, 15, 20 and 24 hours. A Dopant of 10% weight Mg were used as a wetting agent to facilitate the process. Measurement of ZrO2/Al characteristics include variability of mass gain, density, porosity, microhardness, as well as wear rate of the material. In addition to examination of holding time effect, a combination of optical microscope and SEM examination were used to analyze micro structure of ZrO2/Al, while EDS were used to test its chemical composition. This research shows that increased holding time could increase mass gain, porosity, and microhardness of the proposed material. On the contrary, this study reveals that increased hoding time will result decreasing density and wear rate of the proposed material. The most favourable characteristics of the proposed materials were reached after 24 hours, i.e. as much as 25,75 gr in mass gain, 3,16 gr/cm3 in

density, 7,7% in porosity, 1188 VHN in microhardness and 19,09 mm3/mm x 10-8 in wear rate. The phase being formed from the proposed material were Al2O3, spinel (MgAl2O4) and ZrO2.</i>