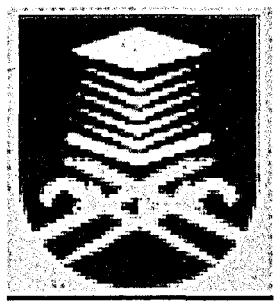

A STUDY ON THE EFFECTS OF SINTERING TEMPERATURE ON THE DENSIFICATION OF ALUMINA

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A thesis submitted in partial fulfillment of the requirements for the award of Bachelor Engineering (Hons) (Mechanical)

Faculty of Mechanical Engineering

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APRIL 2005

ACKNOWLEDGEMENT

No one will ever achieve much without contribution of others and creating this thesis was no exception. We have been pleased with the encouragement and assistance of so many wonderful professional educators and talented people who most profoundly influenced our life that we could never thank them all. But we would like to publicly acknowledge a few to whom we are particularly indebted.

We owe a special gratitude to Associate Professor Nor Aini Wahab who have been vital supporter since the inception of this project, all her guidance, patient, supervision and enlightened us with detailed comments throughout the preparation and the completion of this thesis.

We would like to extend our special thanks to Mrs. Junaidah Jun as our co-advisor and Mr. Husin for their patience while guiding us. Their knowledge that they gave to us is priceless. Also not forgotten is to Mr. Hayob and Mr. Hairi, our lab assistant for their help and patience while we was doing our research and report at laboratory.

We are blessed and forever indebted to our family for their encouragement, loving, caring and understanding during, while solving the behind scene challenges, those quite contributions will never be known, except us. And finally, to all my friends who have contributed in one way or another. Thanks again.

ABSTRACT

Aluminium Oxide (Al_2O_3), also known as alumina is an advanced ceramic material with a wide range of applications. Therefore, it is important to analyze and understand the impact of processing on its properties.

In this project, alumina powder was mixed with a small amount of magnesium oxide (MgO) also know as magnesia powder. The mixture was based on 95%wt alumina powder and 5%wt magnesia powder. The mixture then pressed at 20 tons by using hydraulic press for 5 minutes and sintered at 5 different temperatures, ranging from 1500°C to 1700°C. The samples were then subjected to 3 characterization tests in order to determine the density, percentage of porosity, hardness and percentage of shrinkage.

The percentage of shrinkage was determined by using a basic equation of the size ratio between before and after sintering process. Interconnected porosity was determined by using optical analyzer and 'water absorption method'. 'Water absorption test' also has been used to determine the bulk density of the samples. Hardness of the sintered samples were determine by using the Equastat hardness tester which is based on the static Rockwell measuring principle, especially suitable for hardness measurement on small parts.

For sintering temperature of 1500°C, the average shrinkage percentage for thickness and diameter are 57% and 6% respectively. The shrinkage percentage for thickness and diameter increased to 61% and 15% respectively as the sintering temperature is raised to 1700°C. The mean percentage of pores obtained from optical analyser test decrease from 6.96% to 0.23% as the sintering temperature is raised from 1500°C to 1700°C. On the other hand, the values obtained from water absorption test show reduction of porosity from 7.92% to 0.04% as the sintering temperature is raised from 1500°C to 1700°C.

Both tests showed that higher sintering temperature results in a more dense structure which is associated with lower percentage of porosity.

Hardness test result show the value increases from temperature of 1500°C to 1700°C. At 1500°C the mean value of hardness is 150 HV whereas at 1700°C the value of hardness is 838 HV. The density value determined from water absorption test also shown an increase due to high temperature. At 1500°C the density value is 2.6687 g/cm^3 however at 1700°C the value increases to 3.4284 g/cm^3.

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