

**FINAL PROJECT**

**THE EFFECT OF ALLOY COMPOSITIONS ON THE  
MICROSTRUCTURE AND MECHANICAL PROPERTIES  
OF CERAMIC MATRIX COMPOSITE FORMED BY  
COMBUSTION SYNTHESIS**



Submitted as a Partial fulfillment of The Requirements for Getting Bachelor  
Degree of Engineering in Mechanical Engineering Department

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**2014**

## **DECLARATION OF RESEARCH AUTHENTICITY**

I assert verify that the research entitles:

### **THE EFFECT OF ALLOY COMPOSITIONS ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF CERAMIC MATRIX COMPOSITE FORMED BY COMBUSTION SYNTHESIS**

That made to fulfill some of the requirements to get Bachelor Degree of Engineering in Mechanical Engineering Department University Muhammadiyah of Surakarta, as far as I know is not a plagiarism of a research that has been published, except the information source that to solve the problems.

Surakarta, September 2014

The Writer



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The Final Project entitles "THE EFFECT OF ALLOY COMPOSITIONS ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF CERAMIC MATRIX COMPOSITE FORMED BY COMBUSTION SYNTHESIS" has been approved by supervisors for getting the Bachelor Degree of Engineering in Mechanical Engineering Department Universitas Muhammadiyah Surakarta.

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## DEDICATION

This Research paper is dedicated to:

Allah SWT,

Thanks for the best everything that Allah SWT given for me and thanks for love that always make me to never give up to do the best. I believe that Allah SWT will always give me the best for everything.

My beloved Mother (Hj. Elpi Hariani. S Pd) and Father (H. Siswadi.S .Pd)

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As long as I know you, you make me to be focus, spirit, and better.

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Thanks for your prayer, love, support and everything.

All my friends,

Thanks for your supports and love me.

## **MOTTO**

Where there is a will there is a way. (FK)

There isn't word impossible with strong will. (YR)

With faith and morality I'll be strong, without faith and  
morality I'll be weak.

Strength does not come from physical capacity. It comes  
from an indomitable will. (Mahatma Ghandi)

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Surakarta, September 2014  
The Writer



**Yudha Rahman Awallu**



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## List of Symbol

$n = \text{integer}$

$\Lambda = \text{wavelength}$

$d = \text{distance}$

$\theta = \text{angle}$

# THE EFFECT OF ALLOY COMPOSITIONS ON THE MICROSTRUCTURE AND MECHANICAL PROPERTIES OF CERAMIC MATRIX COMPOSITE FORMED BY COMBUSTION SYNTHESIS

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## **ABSTRACT**

*The purpose of this research was to investigate the effect of alloy compositions on the microstructure and mechanical properties of product form by combustion synthesis. The research was done using powder materials such as C, Al, and TiO<sub>2</sub>. Using a reaction equation of  $3\text{TiO}_2 + (4+X)\text{Al} + 3\text{C} \rightarrow 3\text{TiC} + 2\text{Al}_2\text{O}_3 + (X)\text{Al}$ , the powders was balanced to form a mixture which subsequently compacted to form a pellet. The composition of mixture was varied with excess of Al from 20%, 40%, 60%, 80%, to 100%. The ignition of combustion synthesis was done using arch flame. The results of the research showed that the ignition and combustion synthesis were succesfully observed in the reacted products. Using XRD and SEM observations, it was shown that Al and Al<sub>2</sub>O<sub>3</sub> are the dominant phases of the synthesized products. Meanwhile, the microhardness test showed that increasing the content of Al has reduced the hardness. The higher hardness was observed in the product with highest content of Al<sub>2</sub>O<sub>3</sub>. This research has shown that the aluminium alloyed with Al<sub>2</sub>O<sub>3</sub> formed by combustion synthesis has significant influence on the mechanical properties of product, with a substantial increase in its hardness.*

**Keywords: Combustion synthesis, Aluminium alloys, XRD, SEM, Microhardness.**