

# COMPARATIVE STUDY ON MECHANICAL PROPERTIES AND MICROSTRUCTURE OF BINARY ALUMINIUM ALLOY USING SAND AND GREEN SAND MOLDS

N.M.Ichwan,J.B.Shamsul,C.M.Ruzaidi and C.P.Faizul.

School of Materials Engineering,  
Universiti Malaysia Perlis (UniMAP)  
UniMAP's Academics Complex,  
Taman Muhibah,Jejawi 02600 Arau,Perlis

## Abstract

Products of binary system especially for aluminium alloys and others binary are of great use.However,mechanical properties of these products are still low because of wrongly chosen the types of molds.Therefore,it is necessary to choose the correct type of molds that suitable and compatible for some kind of binary products.In this research paper,we would like to compare the results of cast product from sand mold and green sand mold for a type of aluminium binary alloy product.

Keywords:Non-ferrous alloys,Sand Moulding;Foundry Metallurgy

## Introduction

There are many types of non ferrous alloy such as aluminium alloy.Aluminium alloy are widely used because of its low density and also has good of mechanical properties.The products of aluminium alloy on the products made of iron and steel.Besides that aluminium alloy are non corrosive or corrosion resistance.

Aluminium alloy is one of the few metals that can be cast by all of processes used in casting metals.The other processing in casting are permanent mold casting,sand casting,plaster casting ,investment casting and continous casting.Other processes such as squeeze casting and hot isostatic pressing are also mentioned.Using of sand and green sand mold means to compare the mechanical properties.

## Experiment and Discussion

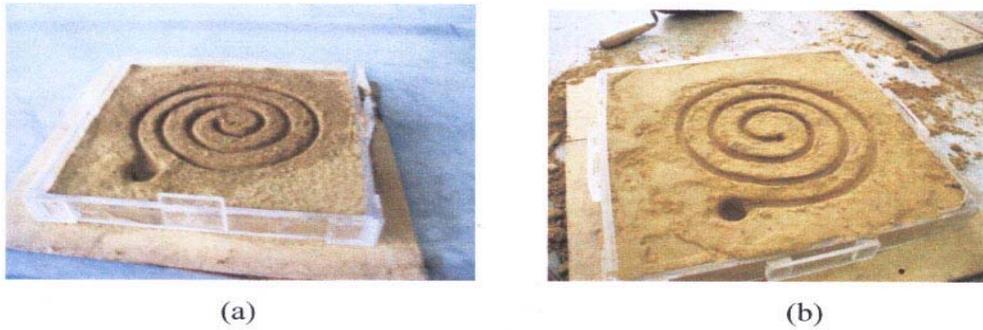
This study is about to analyze the mechanical properties and microstructure of aluminium alloy with sand and green sand mold process.The experiment was doing to show how the different mold will affect the aluminium properties.The testing that have done to show the different of properties tensile test,hardness and also flowability and microstructure.The result of chemical composition as shown as Table 1.

Table 1.Chemical composition of aluminium alloy

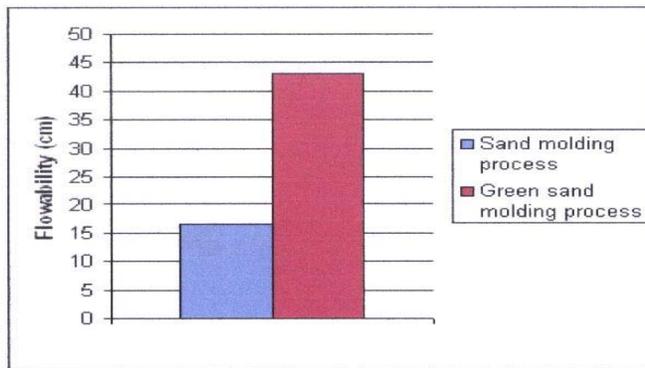
Elements	Percent (%)
Aluminium	63.914
Copper	26.227
Manganese	9.859

**Flowability:**

According to the flowability there are parameters that should be considered while doing a casting process such as type of mold and pouring temperature. For this used pouring temperature 700° C. The molds and table of flowability as shown Fig 1; and Graph 1 Tensile strength shown as Graph 2; Table 2 and Table 3 and Table 4.



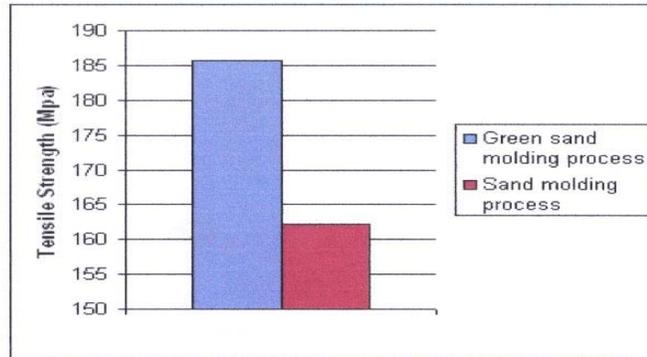
**Figure 1** : Flowability mold. (a) Sand molding mold, (b) Green sand molding mold.



**Graph 1** : Flowability graph of sand and green sand molding process

## Tensile Strength

The result of testing as Graph 2; Table 2 and Table 3.



**Graph 2 :** Graph tensile strength of send and green sand molding process

**Table 2 Mechanical properties of Green sand Molding Process**

Test	Tensile Strength (MPa)	Yield Strength (MPa)	Modulus Young (MPa)
T1	196.687	1311.958	2360.247
T2	175.208	1174.940	2102.494
T3	185.208	1274.946	2290.494
<b>Average</b>	<b>185.701</b>	<b>1253.948</b>	<b>2251.078</b>

**Table 3 Mechanical Properties of Sand Molding Process**

Test	Tensile Strength (MPa)	Yield Strength (MPa)	Modulus Young (MPa)
T1	151.878	2012.004	3645.057
T2	152.765	2198.449	3666.370
T3	181.878	2318.909	3712.075
<b>Average</b>	<b>162.174</b>	<b>2176.454</b>	<b>3674.500</b>

## Hardness

After inspect under light microscope sample were test with micro Vickers hardness  
The experimental results of hardness test as a function of dendrite spacing for Green sand molding process and sand molding process are shown in Table 4.

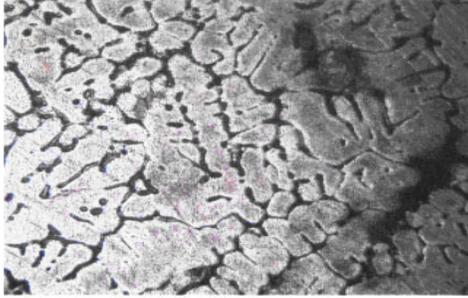
**Table 4 Vickers Hardness Test**

Test Load=0.03

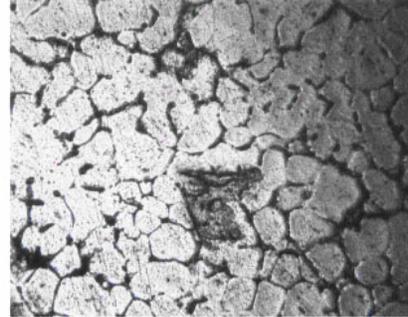
Test	Sand Molding	Green Sand Molding
T1	45.90	41.50
T2	47.40	43.70
T3	48.34	46.00
<b>Average</b>	<b>47.34</b>	<b>43.73</b>

## Microstructure

A part of tensile specimen was cut to small dimension for microscope analyzing sample preparation .After grinding, polishing and etching the sample was analyzing under light microscope and the result shown as figure below: The microstructure of aluminium alloy between both processes was having not many differences.



(a) 10x



(b) 10x

Figure (a) is microstructure of aluminium alloy of sand mold

Figure (b) is microstructure of aluminium alloy of green sand mold

## Conclusion

1. The different molding process of aluminium alloys casting resulting the differences mechanical properties.
2. Green sand mold is more toughness than sand mold
3. Sand mold have more high hardness than green sand but more brittle.
4. Flowability of green sand mold was more good than sand mold.

## References

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