EFFECT OF ANODIZING ON MECHANICAL PROPERTIES OF ALUMINUM ALLOY 2024-T42

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ABSTRACT

2024-T42 Aluminum Is A Type Of 2024-T3 Series Aluminum That Has Been Heat Treated Into 2024-T42 Series Aluminum. Natural Aging Is One Of The Heat Treatment Processes, On Aluminum Can Be Done Coating Namely Anodizing Aluminum, Anodizing Process For The World Of Aviation Is As A Coating On The Surface Of Aluminum To Avoid Corrosion And Piston Coating To Reduce Friction On The Surface, The Anodizing Process Can Also Affect The Mechanical Properties Of The Aluminum. This Study Was Conducted To Determine The Mechanical Properties Of Aluminum After Anodizing And To Find Out Whether The Mechanical Properties By Testing Vikers Hardness And Charpy Impact Have Increased Or Decreased. With This Research, It Is Expected To Know The Mechanical Properties Of 2024-T42 Series Aluminum After Anodizing With A Time Variation Of 30, 40, 50, 60 Minutes And A Strong Current Of 24 Volts, 3 Amperes. From The Final Results Achieved From This Study, Namely In Testing The Vikers Hardness Of The Anodizing Process, The Average Increase Was 8.5% With The Highest Value Being 80.03 Hvn With A Time Of 60 Minutes, While For Impact Testing An Average Increase Of 9.5% With A Value Of 1.306 J / Mm2 With Anodizing Time Of 60 Minutes. So It Can Be Concluded That The Anodizing Process On Aluminum Can Affect The Mechanical Properties Of Aluminum. The Longer The Anodizing Process Eats The Value Of The Vikers Hardness Test And The Charpy Impact Test Will Increase.

Keywords: Aluminum, Anodizing, hardness vikers, impact

1. INTRODUCTION

Pure aluminum is a type of aluminum that is easily damaged and brittle so other materials are needed to be combined and become a new material, namely aluminum alloy. In the aviation industry itself uses a lot of Aluminum Alloy almost all parts of the aircraft, especially on aircraft frames that require materials with large size, light weight, low production costs, durability and good corrosion resistance. There are several types of Aluminum Alloy, one type is Aluminum Alloy 2024.

Aluminum 2024-T42 Is A Type Of Aluminum 2024-T3 Series That Has Been In Heat Treatment Into Aluminum 2024-T42 Series, Natural Aging Is One Of The Heat Treatment Processes Carried Out At Room Temperature With Certain Time Variations With The Aim To Form Precipitates That Can Improve Mechanical Properties In Aluminum Such As Mechanical Properties Of Vikers Test And Impect Test, For The Optimal Time Of Natural Aging On 2024-T42 Aluminum Is For 48 Hours With A Hardness Value Of 90.08 HRB, With A Tensile Strength Of 410.33 Mpa, And Yield Strength Of 252.71 Mpa, And Elongation Of 22.95%. In Addition, Aluminum Alloys Can Be Surface Coated Or Surface Painted On Aluminum. One Of Them Is The Anodizing Process.

In The Anodizing Process (Prastya, 2016) Shows The Anodizing Process On 1XXX Series Aluminum Produces The Highest Hardness And Oxide Layer Thickness Of 45.3 VHN And 80 Mm With A Current Strength Of 2 Amperes. For Other Research Results, Namely By (Fajar Nugroho, 2015) The Effect Of Anodizing Current Density On The Hardness Value Of The 2024-T3 Series Aluminum Alloy Plate With A Research Method Using The Vikers Hardness Test, It Produces A Hardness Value That Increases With The Longer The Immersion Time In The Electrolyte Solution. This Increase In Hardness Occurs In All Variations Of The Current Used. The Longer The Anodizing Process Is Carried Out, The Thicker The Aluminum Oxide Layer On The Specimen Will Be. So It Can Be Concluded That The Hardness Value Of AA 2024-T3 Alloy Aluminum Plate Is Influenced By The Current Meeting And Anodizing Time With Varying Values And The Greater The Anodizing Current Meeting, The Shorter The Optimal Anodizing Time Tends To Be And The Longer The Anodizing Time, The Greater The Aluminum Oxide Layer Will Be Produced With An Increasing Hardness Value.

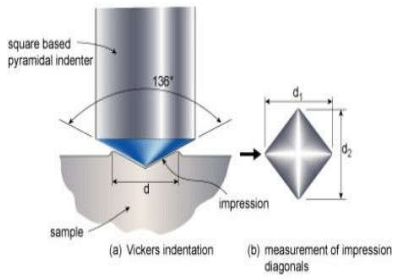
2. METHODS

2.1. ANODIZING

Anodizing is a coating process on aluminum to add mechanical properties to aluminum. Aluminum coating aims to increase aluminum surface hardness and aluminum resistance from corrosion, the anodizing process has an important role in the manufacturing industry, such as the machinery industry, motor vehicle assembly, aircraft industry, Anodizing is the name for the electrolysis process in anodic coating where the metal or aluminum to be anodized is positioned as an anode. In anodizing, an oxide layer is produced at the anode, and the release of H2 gas at the cathode reaction that occurs during anodizing.

2.2. VIKERS HARDNESS TEST

Hardness is the ability of a part to resist penetration or penetration by another harder material (penetrator). Hardness tests can be determined by pressing a hardened steel ball or diamond cone against the surface of a workpiece, and then measuring the indentation trace. There are several methods to perform hardness testing on a metal such as the Brinell, Rockwell, Vickers, etc. methods. This method is done by pressing the tested object with a pyramid diamond identifier with a rectangular base and an angle of 136° against the opposite surface. The resulting indentation pressure will leave marks such as indentations on the surface of the tested specimen. This test uses the ASTM E92 standard which is intended for metal material test objects and is used for the Vickers hardness test.



Gambar 2. 1 Identor Hardnes Vickers

To determine the hardness value of the tested material, the average diagonal of the indentation must first be measured under a microscope. The vickers hardness value can be obtained by dividing the amount of test load used by the previous stress area of the material under test.

Description

HV = P/A

HV = Hardness Vickers;

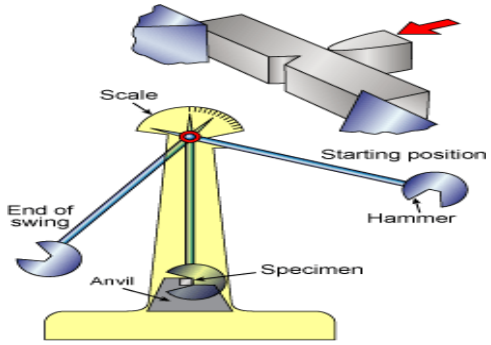
P = The magnitude of the test load;

A = Surface area of test piece pressure marks

2.3 CHARPY IMPACT TEST

mpact test materials (Charpy Impact Test) are used to build structures that withstand loads. An engineer needs to know if the material will withstand the conditions under which the structure will be used. Important factors that affect the strength of structures include testing at low temperatures, higher loads and strain rates due to wind or impact, and stress concentration effects such as cracking. These tend to promote fractures. In a broader sense, the complex interaction of these factors can be incorporated in the design process using failure mechanism theory. In these impact tests, a large amount of energy is absorbed by the material in order to failure mechanism. In this impact test, a large amount of energy is absorbed by the material to fracture, which is a measure of the material's ability to withstand impact or toughness.

This test uses the ASTM E23 standard which is intended for test objects with metal materials and is used for impact tests. The conclusion of the above discussion is that the impact test aims to determine the ability of the test object or material when receiving an impact load that will produce an energy to break the test object with a certain method.



Gambar 2. 2 Test impact charpy

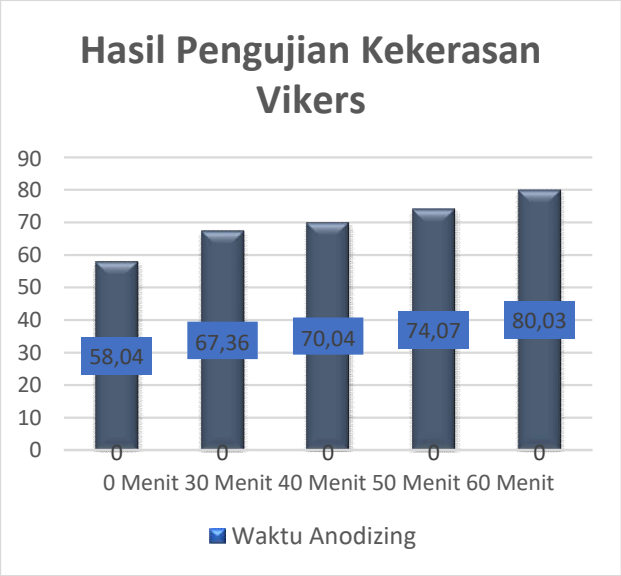
3. RESULTS AND DISCUSSION

Based on the explanation of the previous research methodology, the author will present the test results of the specimens that have been obtained in the vikers hardness test and charpy impact test.

3.1 VIKERS HARDNESS TEST RESULTS

No	*Variation time*	*Hv 1*	*Hv 2*	*Hv 3*	*Average hvn*
1	*0 MINUTES*	*57,05 hv*	*58,07 hv*	*59,01 hv*	*58,04 HVN*
2	*30 MINUTES*	*67,02 hv*	*69,03 hv*	*66,05 hv*	*67,36 HVN*
3	*40 MINUTES*	*70,01 hv*	*69.04 hv*	*71,08 hv*	*70,04 HVN*
4	*50 MINUTES*	*73,06 hv*	*75,08 hv*	*74,09 hv*	*74,07 HVN*
5	*50 MINUTES*	*81,03 hv*	*79,05 hv*	*80,01 hv*	*80,03 HVN*

TABEL 3. 1 VIKERS HARDNESS TEST RESULTS



GRAPH 3. 1 VIKERS HARDNESS TEST RESULTS

So it can be concluded that the average increase in the anodizing process with vikers hardness testing and time variations is 8.5%.

3.2 Charpy Impact Test Results

TABEL 3. 2 Charpy Impact Test Results

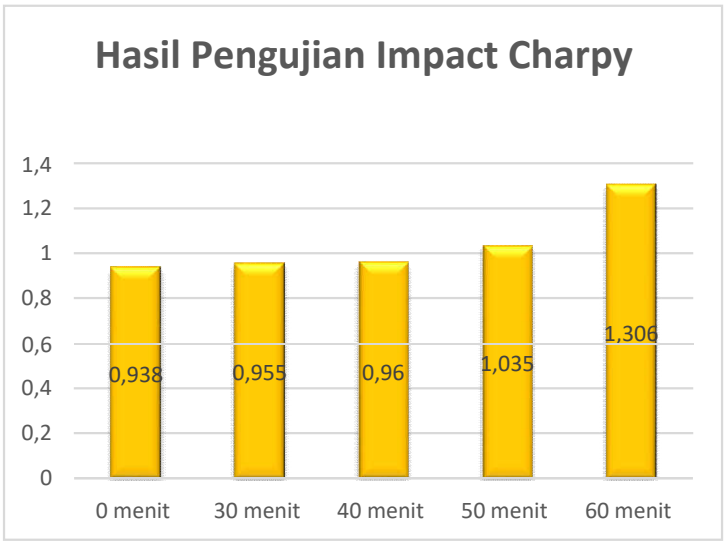
Description;

W = pendulum weight(kg)

L = distance from fulcrum to pendulum weight point(m)

α = initial angle (˚)

ß = final angle (˚)



GRAFIK 3. 2 CHARPY IMPACT TEST RESULTS

So it can be concluded that the average increase in the anodizing process with charpy impact testing and time variations is 9.05%.

4. CONCLUSIONS

In the tests carried out, we can draw the following conclusions:

anodizing time	*W*	*L*	*α*	*ß*	*Capacity Absorbed*	*HI (J/mm²)*
	kg	*m*	*˚*	*˚*	*kg-m*	
30 MINUTES	*13,17*	*0,6*	*140*	*29*	*9,723*	*0,960*
				30	*9,672*	*0,955*
				31	*9,620*	*0,950*
40 MINUTES	*13,17*	*0,6*	*140*	*34*	*9,453*	*0,933*
				35	*9,395*	*0,927*
				36	*9,335*	*0,922*
50 MINUTES	*13,17*	*0,6*	*140*	*3*	*10,463*	*1,033*
				4	*10,452*	*1,032*
				5	*10,444*	*1,040*
60 MINUTES	*13,17*	*0,6*	*140*	*3*	*10,463*	*1,033*
				4	*10,452*	*1,032*
				6	*10,434*	*1,040*

1. 2024-T42 aluminum material that undergoes

anodizing process with time variations of 30, 40 50 and 60 minutes experiences changes in mechanical properties with an increase in vikers strength and charpy Impact strength.

2. Anodizing process or coating process on 2024-T42 aluminum can affect mechanical properties in viker hardness specimens. The final results achieved from this study are that the vikers hardness test without anodizing is 58.04 HVN with a time of 30 minutes producing an average hardness of 67.36 HVN, while a time of 40 minutes produces an average hardness value of 70.04 HVN, and a time of 50 minutes produces an average value of 74.07 HVN, for a time of 60 minutes produces a hardness value with an average of 80.03 HVN. With the average results of the increase in the anodizing process with vikers hardness testing and time variations of 8.5%. As for the results of the Charpy Impact specimen testing. The final results achieved from this study are that the impact test with 30 minutes of anodizing will produce an average value of 0.955 J/mm2, while for anodizing with 40 minutes will produce an impact value with an average of 0.960 J/mm2, and for the anodizing process with 50 minutes produces an average value of 1.035 J/mm2, for 60 minutes produces an average value of 1.306 J/mm2. With the average result of the increase in the anodizing process with charpy impact testing and the time variation of 9.05%.

AUTHORS' CONTRIBUTIONS

1. *The authors take full responsibility for the writing of this article.*
2. *The author has approved the article for publication as per the aviation college Final Project guidelines.*

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