American Journal of Engineering Research (AJER) **2023**
American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-12, Issue-4, pp-19-24
www.ajer.org
Research Paper Open Access

The Characterization of Corrosion Behaviors of AA6082, AA6063 and AA1050 Series Aluminum Profiles

Bahadır Karaca*[1], Bilgehan Tunca[1], Gülçin Kalkan[1]
[1]*Zahit Alüminyum San. Tic. A.Ş., 01410, Adana, TURKEY)*
Corresponding Author: Bahadır Karaca
Corresponding Author E-mail: b.karaca@zahit.com.tr

Abstract: It is aimed to investigation of the corrosion behaviour of 6082, 6083 and 1050 Aluminium Alloy before and after the pre-surface finishing process. The aluminium profiles of each alloy with 15 cm was performed pre-surface finishing. Then the machu test was performed with 5% salt solution in 48 hours. It was no observed that any leakage more than 0.5 mm. The samples of aluminium profiles which were subjected salt test with acetic acid were investigated in every 200 hours. It was observed that it did not exceed the allowable corrosion size of 16mm². It was found that the increasing of the corrosion at sample which was not processed surface finishing in the corrosion test with NaCI solution. Also it was found that the increasing of the corrosion resistance of the sample which was processed electrostatic powder paint and anodic oxidation process.
Keywords: Aluminium, Aluminium Alloy, Corrosion, SEM, AA6082, AA6063, AA1050

Date of Submission: 18-03-2023 Date of acceptance: 03-04-2023

I. INTRODUCTION

Passive oxide film which occurs on the metal surface has a critical role in behaviour of aluminium, aluminium alloys and composites based on aluminium. The passive oxide film that exhibites well cohesive, thin and nonporous properties provide high strength to corrosion in atmospheric environment [1]. The attacker salts in aluminium alloys and composite based on aluminium damage to protector oxide film properties [2]. The Corrosion can be defined that metallic materials lose their metallic properties as a result of electrochemical reaction with environment without the need for external energy. The corrosion occurs between two metallic regions or points that have electrical and electrolytic contact with each other and potential diffrence can ocuur between them. While a cathodic reaction occurs on the surface of potentially more of these regions or points, the other active region or point dissolves [3]. The addition of some metals to the Al alloy increases the mechanical properties and causes a decrease in corrosion resistance. It is very sensitive to atmospheric conditions and chemical reactions in environments where aluminium alloys are used. The investigate of corrosion behaviour on the aluminium surface has a crtitical role in order to increase to its resistance to environmental effects and also mechanical properties [4]. Its known that the corrosion resistance of the metal increases with the formation of controlled oxide (Al_2O_3) on the surface of aluminium.Thus, the forming of anodic oxidation on the aluminium surface, structal and chemical behavior have been widely studied [5]. Aluminium alloys exhibit different corrosion behavior, mechanical properties and physical properties depending on the different composition ranges. The most important role in the development of the desired properties of aluminium alloys is based on the basis of the major element/elements [6]. Many resarchs have been studied on the improving of aluminium corrosion behaviour. It was reported that polypyrrole conductive polymer coating on the aluminium improved the resistance of corrosion by Saidman ve Bessone and Naoi and et al., Akundy and Iroh. Also It was reported that polyaniline conductive polymer coating provide to high quality corrosion resistance by Epstein and et al., Akundy and et al., Huerta-Vilca, Conroy and Breslin, Ogurtsov an et al., Karpagam and et al [7]. The most important factors affecting the corrosion properties of aluminium alloys are the resistance of the passive oxide layer on the surface and the chemical and electrochemical behavior of the intermetallic phase particles in the structure [8].

II. MATERIAL AND METHOD

The corrosion behavior of 6082, 6083 and also 1050 aluminium alloys were investigated before and after pre-surface finishing process. Table 1 shows that the chemical compositon of aluminium alloys.

Table 1 The chemical composition of aluminium alloys

	Si	Fe	Cu	Mn	Mg	Cr	Zn	Ti	Al
1050	0,25	0,4	0,05	0,05	0,05	*	0,07	0,05	0,05
6063	0,2-0,6	0,35	0,1	0,1	0,45-0,9	0,1	0,1	0,1	0,1
6082	0,7-1,3	0,5	0,1	0,40-1,0	0,6-1,2	0,25	0,2	0,1	0,1

2.1 Unprocessed Aluminium Profile

The solution NaCI solution with 3.5 % was used for the aluminium profile which was not examined surface finishing. The corrosion was analysed by using potentiodynamic polarization.

2.2 Electrostatic Dyed Aluminium Profile

Electrostatic painting is a process that uses special equipment to electrically charge and fluidize powdered pigment. Then the particles are sprayed on the surface with a powder paint gun. Dyed aluminium profiles were subjected to test which is defined accelerated corrosion test. The aluminium profiles were scratched until it is occured the metal surface with 1 mm width by using tool post. Table and Table show the test parameters is performed for dyed aluminium profile for examine of the corrosion behavior.

Table 2 Machu test parameters

Test Solution	Cabin Temperature (C)	Test Period (hour)
PH 3.0-3.3 % 5	37 + 1.0	48±0.5

Table 3 Acedic acid test parameters

Test Solution	Cabin Temperature (C)	Cabin Pressure (bar)	Salt Solution Flow (lt/st)	Test Period (hour)
PH 3.0-3.3 % 5	35 + 1.1/-1.7	1.0-1.2	0.2-0.3	2000

2.3 Anodized Aluminium Profile

The anodic oxidation that is defined electrochemical process is one of the most important surface finishing method. The electrolyte used is usually an acidic solution. The aluminium to be coated is the anodes of the electrolysis process. The defined and controlled current density is applied for a certain period of time between the aluminium to be coated and a suitable cathode. The artificial ageing and polishing process were performed on the extrude aluminium profiles. Liquid polishing polish and semi-automatic polishing machines with two tables and two brushes were used in the polishing process. Anodic oxidation was performed with 180 g/L H_2SO_4 and 18 V. The anodized alumium profiles was subjected neutral salt test. Table shows the neutral test parameters.

Table 4 Neutral Salt Test Parameters

Test Solution	Cabin Temperature (C)	Cabin Pressure (bar)	Salt Solution Flow (lt/st)	Test Period (hour)
PH 6.5-7.2 % 5	35 + 1.1/-1.7	1.0-1.2	0.2-0.3	480

III. RESULTS AND DISCUSSION

3.1 Corrosion test

The unprocessed aluminium profile exposed to corrosion with 3.5 % NaCI. Fig. 1 shows the unprocessed AA1050 aluminium profile. The comparative analysis was performed for examine the corrosion behavior of different aluminium profiles. It was observed that the corrosion formed on the aluminium surface of all different aluminium alloy.

Fig. 1. Unprocessed Aluminium Profiles (AA1050)

Fig. 2 shows aluminium profiles were exposed to Machu test. Also Fig. 3 shows that aluminium profiles were exposed to with acedic acid in 2000 hours after Machu test. It was found that the corrosion region on the aluminium surface for all different aluminium alloy.

Fig. 2 Dyed AA1050, AA6063 and AA6082 Aluminium Profiles (Machu Test)

Fig. 3 Dyed AA1050, AA6063 and AA6082 Aluminium Profiles (Acedic Acid Test)

Fig. 3 show the anodized aluminium profiles for AA6063, AA6082 and AA1050 series. It can be clearly that corrosion region formed on the aluminium surface in Fig. 4.

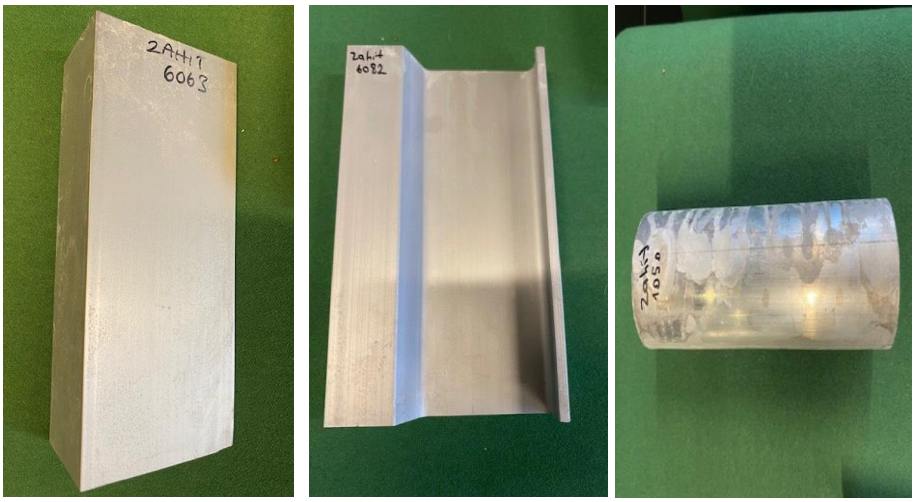
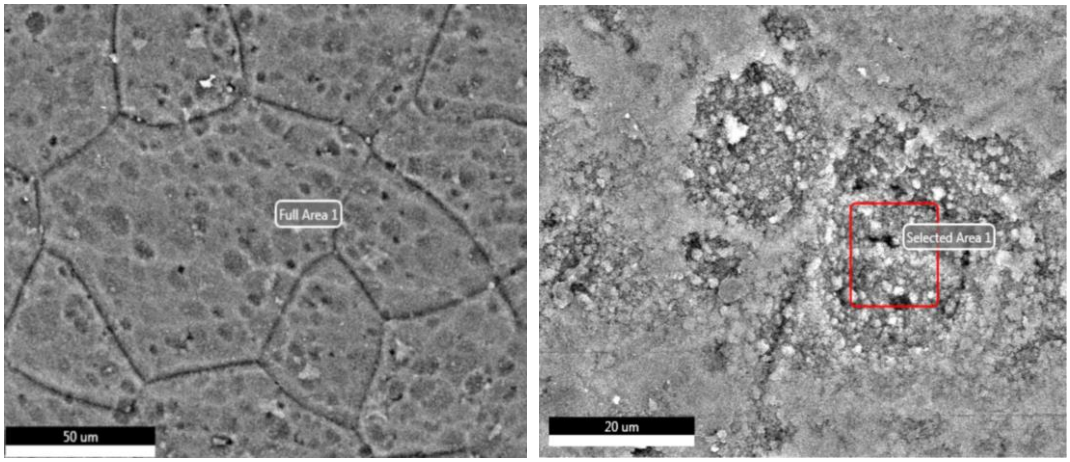


Fig. 4 Anodized AA1050, AA6063 and AA6082 Aluminium Profiles

3.2 SEM Analysis

SEM analysis was performed to investigate the corrosion forming of aluminium profiles. Fig. 5 shows SEM Images of anodized aluminium profiles. It can be clearly that the corrosion region of the aluminium profile surface. It was observed that the corrosion has started after 240 hours in neutral salt test.



a **b**

Fig. 5 SEM Images of anodized aluminium profiles (AA6063)
a) Clean zone (not observed corrosion) b) Corroded region

Fig. 6 shows SEM images of dyed aluminium profiles. It was found that the corrosion region formed on the dyed aluminium profiles. It was concluded that the corrosion region was observed independent on the aluminium alloy which has a different chemical composition.

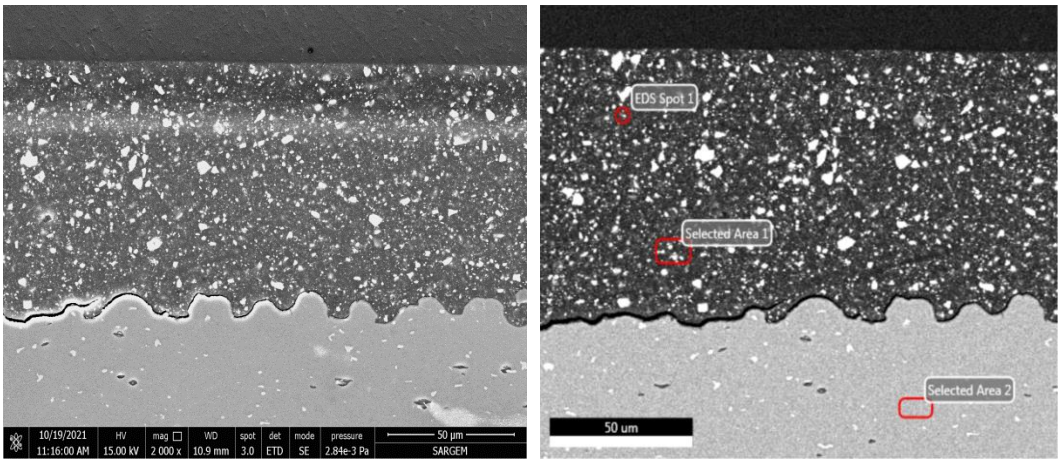


Fig. 6 SEM Images of dyed aluminium profiles (AA6082)

IV. CONCLUSION

Its aimed to investigate the corrosion behavior of AA6082, AA6063 and AA1050 series before and after the pre-surface finishing process. The extrude aluminium profiles, anodized aluminium profiles and dyed aluminium profiles were tested in different conditions for investigate corrosion behavior. It has been observed that the corrosion formed on the aluminium profile surface which is not expose to any surface treatment was starting shortly after extrusion process. It was observed that the corrosion formed on the anodized aluminium profiles with coating 10-11 µ after 240 hours. Also the dyed aluminium profiles with coating 60 µ exposed to corrosion after 1800 hours. Finally, It was concluded that the corrosion region was observed independent on the aluminium alloy which has a different chemical composition.

REFERENCES

[1]. Karabulut H., Karacif K., Çıtak R., 2019. The Investigation of Effects of Mechanical Alloying Duration on Corrosion Behavior of Aluminium Composite Reinforced with Al_2O_3. International Journal of Engineering Research and Development. 11 (2).
[2]. Özakın B., Investigation of Stress Corrosion Behavior of Aluminum Alloys Under Different Conditions, MsC Thesis, 2014, Atatürk University.
[3]. Mrowka G., 2010. Influence of Chemical Composition Variation and Heat Treatment on Microstructure and Mechanical Properties of 6XXX Alloys. Archives of Materials Science and Engineering 46 (2)

[4]. Ezuber H., El-Houd A., El-Shawesh F., 2008. A Study on Corrosion Behavior of Aluminium Alloys İn Seawater. Materials and Design, 29 (4) 801-805.
[5]. Akcan E., Mehmetalioğlu C., Özüyağlı, Akıncı A., 2016. The Investigation of Effect Interface on the Anodization in Aluminium Alloy. Sakarya University, Institute of Science Journal, 3, 409-415.
[6]. Karacif K., Kıyak T., İnem B., 2010. The Investigation of Corrosion Behvaiour of Conducting Polymer Coated Aluminium and Chromated Aluminium. J. Fac. Eng. Arch. Gazi Univ. Vol 25, No 2, 235-241.
[7]. Sertçelik F., The Effect of Thin Film Produced Anodized and Surface Treatment on the Corrosion Resistance of AA6063, 1999, PhD Thesis
[8]. Uslu E., Çatar R., Çolak M., Determination and Comparison fo Corrosion Properties of Aluminum Casting Alloys Containing Si and Cu. 2017. Engineering Sciences