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INVESTIGATION OF MECHANICAL PROPERTIES OF NATURAL AGED AA 7075 ALUMINUM ALLOY

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ABSTRACT

Heat treatment, which requires heating and cooling of solid metals and chemical compounds without the formation any difference in mechanical properties is defined as processes which provide the change. Some features required to provide an Al alloy has been widely practiced in the heat treatment. Hardness and strength can be increased by heat treatment may also be enhanced mechanical properties as well as other terms.

AA 7075 natural aging of aluminum alloys obtained after the corrosion resistance of FeAl, Al_2Cu, Mg_2Si ve AlFeSi phase were investigated. A sample of 7075 aluminum alloy to homogenize microstructures in the conventional oven 20 minutes at 530 ° C, allowed to stand was subjected to water quenching. Then samples of phase transformations in the alloy to ensure the normal room conditions (25 ° C) 1 week, 1 month and 2 months natural aging method was used in the. After natural aging of the samples; characterization of the internal structure, microhardness and corrosion resistance were examined. Optical microscope, XRD analysis and SEM images based on the results obtained from the amount of the precipitate increased with time and depending on the increased amount of precipitate was increased mechanical properties in the material.

Key Words: AA 7075, Aluminum Alloy, Natural aging, Precipitation hardening, Mechanical Properties.

1. INTRODUCTION

In order to provide certain desirable properties of aluminum alloys have been applied on the heat treatment effects to a large extent. By the application of heat treatment such as strength and stiffness can be increased, other strains heat treatment allows for the improvement of mechanical properties of alloys [Dennis, 1987].

Aging hardening can be accelerated by heating the quenched alloy. By heating in the aging was performed "artificial aging" which spontaneously at the "natural aging" is called. In both cases the metal is a special form of precipitation hardening in science [Tekin, 1984].

Heat treatment, which requires heating and cooling of solid metals in chemical composition and mechanical properties, without there being any noticeable change is described as providing a heat treatment. Alloys being heat treated, the solid solubility of the element main alloy, at higher temperatures compared to normal temperature, a significant increase are alloys [Dennis, 1987].

Some metals, in addition to features not form solid solutions, intermetallic chemical compounds can be formed into. These are the main elements that constitute the features of the features of the system often clearly differ. The chemical compositions of these components are not fixed to the fore and may vary between certain limits. Thus, Cu ve Al, CuAl2 intermetallic compounds in the composition that forms this genus. But found scattered in the alloy because they increase the strength of the system. Such a heat treatment of the alloy elements present in the intermetallic compound, may be incorporated within the main body by the solid solution. Thus, by a process different and often extremely valuable features, form an alloy obvious [Dennis, 1987 and Ersumer, 1980].

In this study, mechanical properties of AA 7075 aluminum alloy in the conventional oven aged natural were investigated. After 1 week, 1 month and 2 months of natural aging process, the internal structure (optical microscope, SEM) characterization, XRD analysis and the tensile test are studied.

2. MATERIAL AND METHOD

2.1. Sample Preparation

20 mm in diameter, 1.5 meters in length with AA 7075 alloy material at a low speed saws cutting 10 mm in length was made (Figure 1). 20 mm wide, 10 mm long specimen cut cutting caused by burrs file and then sequentially laboratory 280, 320, 400, 600, 800, which grinding with grinding is made, and the samples were made ready.

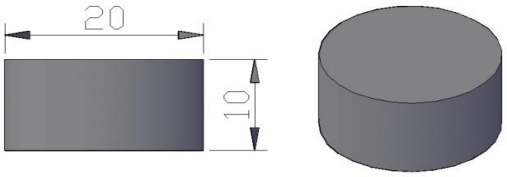


Figure 1: View and dimensioning of the sample prepared

2.2. Natural Aging

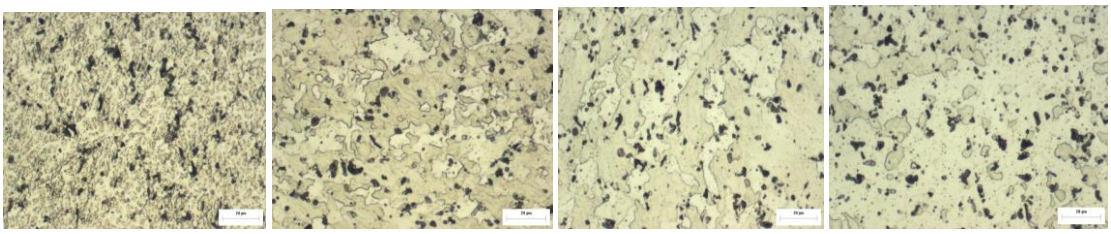
1. Our oven was prepared before the operation.
2. Brick refractory bricks arrayed on the samples and was placed into the oven.
3. 20°C/dk oven to increase the oven was operated.
4. The oven temperature was increased to 530°C.
5. The furnace was allowed to stand at this temperature for 20 min.
6. After 20 minutes the samples were left in water.

After cooling the samples were dried. 6 of them taken from the samples being quenched, the samples are subjected to natural aging at ambient conditions. Quenched 6 samples 2 at room temperature for 1 week, after standing, and then the remaining four samples, 2 of the first quenching after 1 month of the other remaining two samples of samples first quenching from 2 months natural aging is subjected to the room temperature aging and was examined. With these operations at ambient conditions for 1 week, 1 month, 2 months, aging treatment was performed.

2.3. Microstructural Analysis

2.3.1. Optical Microscope Analysis

At 530°C, quenched sample optical microscope in the columnar size of the resulting agglomerates is observed. Also some grains homogeneously dispersed in the material is made in the form of small pores is observed (Figure 2/a). But the natural aging time increases observed in samples by melting the location of columnar structures have been replaced by small grains. This internal structure of the grains present in the homogenous distribution of small grains in the form of pores is observed. Also naturally aged 2 months at room temperature a small sample of the beads in the material is decreased by the presence (Figure 2/d).

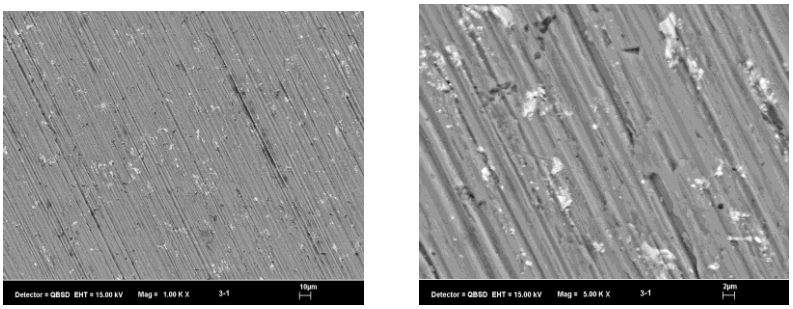


a) **b)** **c)** **d)**

Figure 2: Optical microscope images of the samples,
a) Qenched at 530°C, **b)** 1 Week Naturally Aged, **c)** 1 Month Naturally Aged, **d)** 2 Months Naturally Aged.

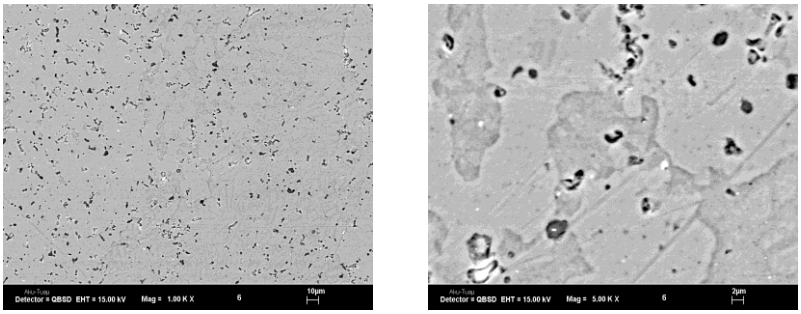
2.3.2. SEM Analysis

In the SEM image of the samples quenched at 530°C (Figure 3) pendant (columnar) shape flake orientation is seen that. 1 months natural aging time at room temperature, but in the form of stalactites in the form of beads formed by melting the new formation of beads with small pores is observed (Figure 4). Resulting in the porous internal structure of the beads shows the distribution in a homogeneous manner. 2 months natural aging time at room temperature, the pores formed in the shape of grain boundaries of the newly formed granules are observed to precipitate. (Figure 5).



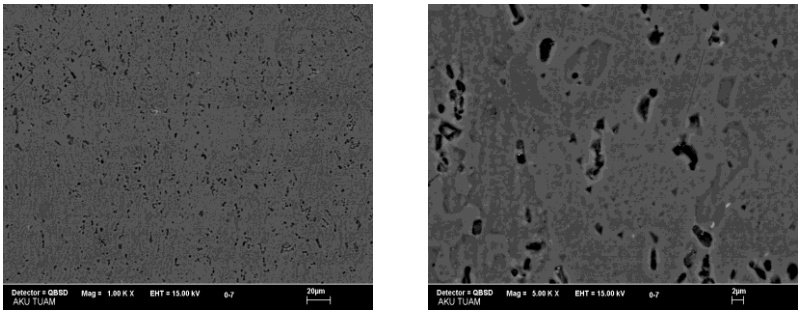
a) **b)**

Figure 3: SEM images of the samples at 530°C quenched; **a)** 1kx , **b)** 5kx magnification



a) **b)**

Figure 4: SEM image of the samples Aged 1 month; **a)** 1kx , **b)** 5kx magnification



a) **b)**

Figure 5: SEM images of the samples Aged 2 months; **a)** 1kx , **b)** 5kx magnification

2.4. XRD Analysis

XRD curves of the sample quenched at 530°C and naturally aged (1 month, 2 months) samples are observed (Figure 6). XRD curves of samples quenched at 530°C FeAl phase that occurs in the peak intensities of the peak intensity curves of samples smaller than the natural aging has emerged.

FeAl intermetallic phase which is present in the sample show that the reduced percentage. This stiffness (Figure 7) and tensile strength values to fall low (Figure 8) is observed that cause the issue.

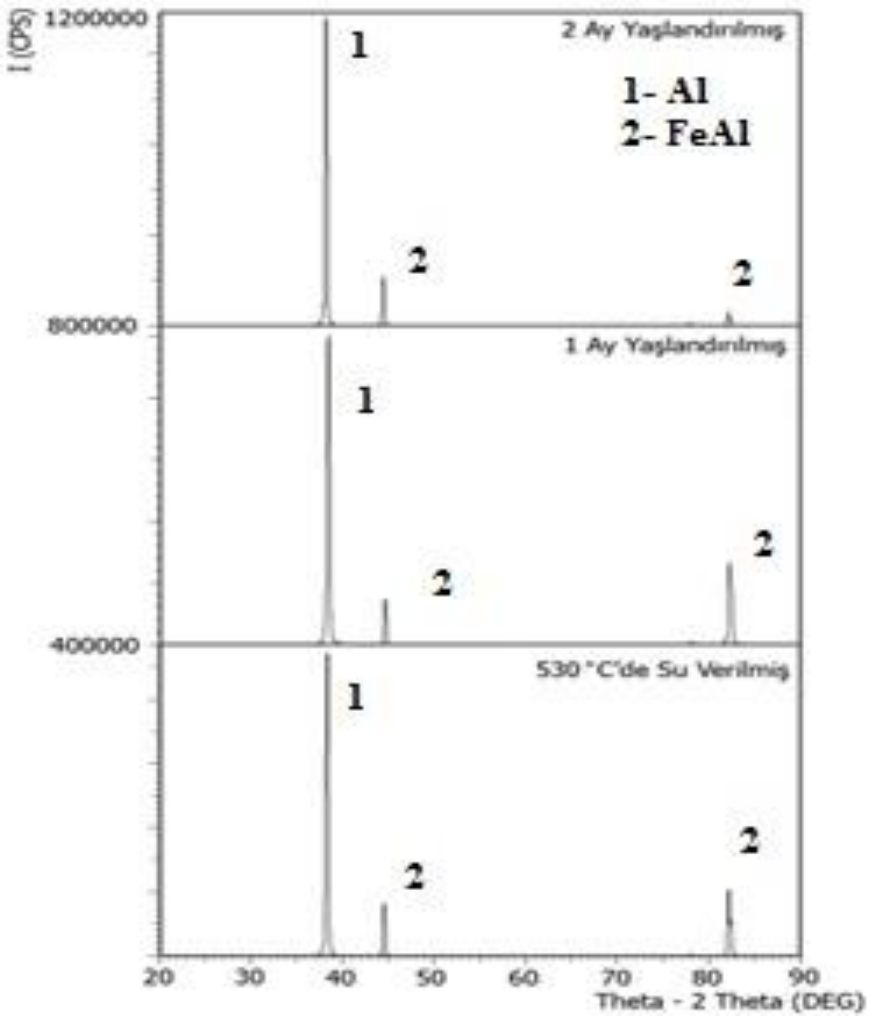


Figure 6: Quenched at 530°C, aged 1 month, 2 months aged XRD graph of samples

2.5. Hardness Analysis

AA 7075 aluminum alloy quenched at 530°C naturally aged at room conditions (1 week, 1 month, 2 months) samples Rockwell hardness curve (Figure 7) is given in. 530oc feal intermetallic phases present in the sample provided in the water due to low amounts has led to low level of hardness.

SEM and optical microscope study appears in the internal structure of the sample present in the form of columns consisting of the grains of coarse and FeAl intermetallic phase reduces the amount of hardness due to paucity can say that. Also lower % elongation tensile strength ratio also decreased (Figure 8) and (Figure 9) is also observed.

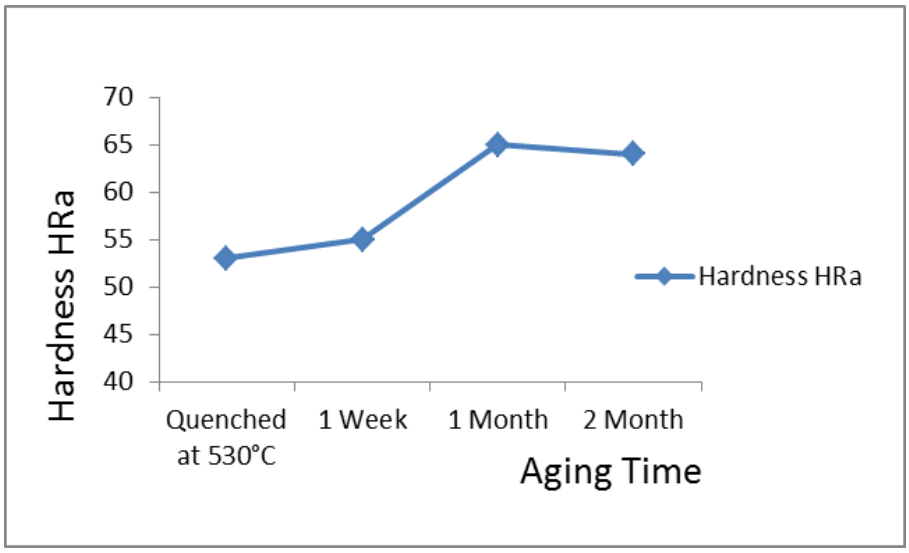


Figure 7: Rockwell hardness values

2.6. Tensile Test Analysis

AA 7075 alloy quenched at 530 ° C and naturally aged, the sample shows the curve of the tensile test (Figure 8). Quenched sample at 530°C occurring naturally aged tensile test samples in the curve F (kg) values increased a little. For samples with increasing aging time F(kg) values is observed to rise. Percent in tensile test, elongation (% ΔL) has been concluded. Accordingly, we made our aging gradually become brittle as a result of raw material as well (Figure 9).

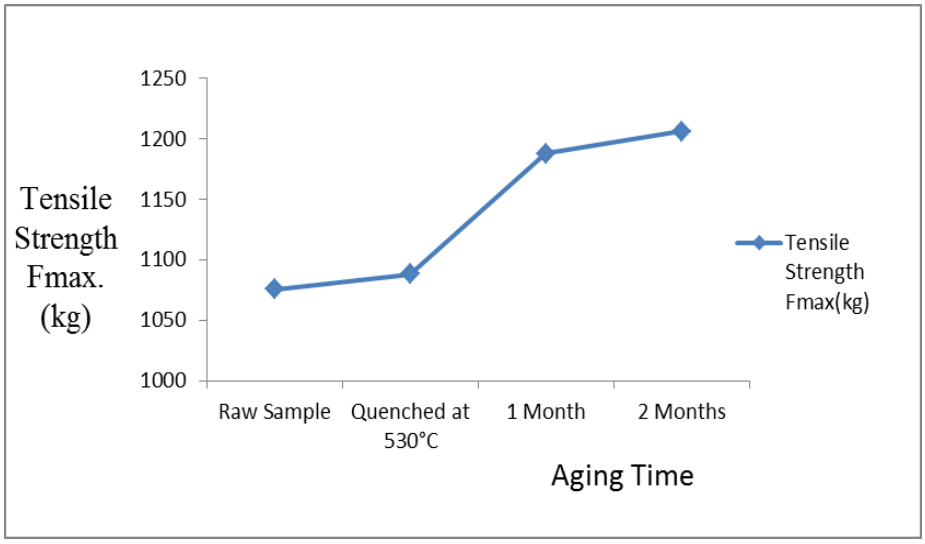


Figure 8: The tensile test of AA 7075 samples

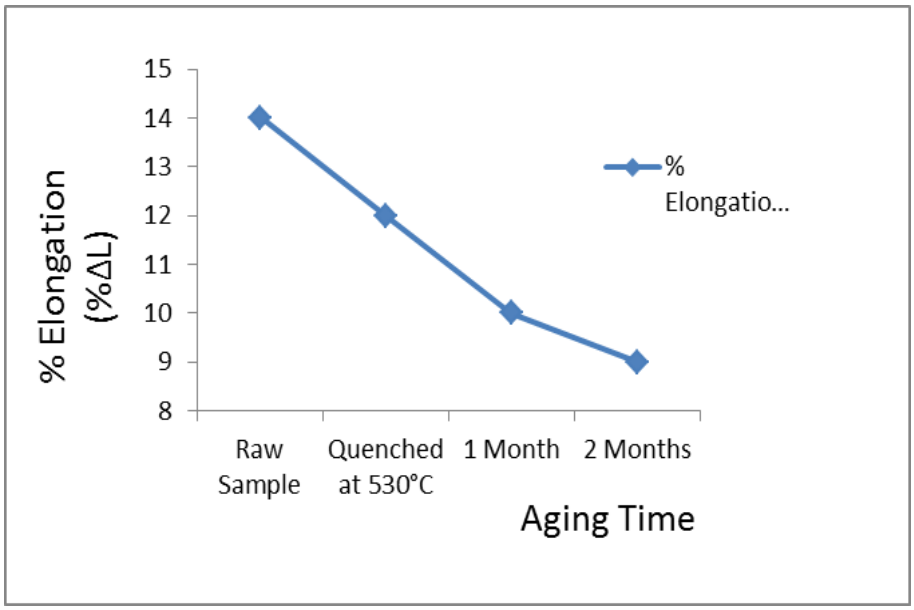


Figure 9: Elongation (%ΔL) of AA 7075 samples

3. RESULTS AND DISCUSSION

1. In this study of the natural aging at ambient conditions alloy system 7075 comprised in the structure and the inner FeAl intermetallic phase are formed.
2. At AA 7075 alloy FeAl intermetallic phases to precipitate during natural aging was determined by XRD analysis.
3. Quenched at 530^{o}C and naturally aged at room temperature of the internal structure present in the sample due to lesser feal Rockwell hardness of the intermetallic phase and mechanical properties were observed to decrease.
4. After quenching hardness and the tensile strength during the first month of natural aging as seen in the curve is increased. If natural aged 2 months FeAl intermetallic phases in the sample as a result of the loss of thermodynamic equilibrium melting curves due to the hardness and elongation percentage has decreased tensile strength also increases the speed is slowed down after 1 month.
5. Aged for 1 month at ambient conditions naturally occurring in the sample increased mechanical properties FeAl intermetallic phase. Namely, Rockwell hardness and tensile strength of the sample was observed to increase.
6. AA 7075 best mechanical properties of alloy systems naturally aged 1 month was observed in the sample.

4. REFERENCES

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BİYOGRAFİLER

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