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# Investigation of Corrosion Properties of Aluminum 5083 Alloy and Graphite Composite

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***Abstract:*** ***The main purpose behind this project is to investigate the corrosion properties of Aluminum 5083 and graphite composite. The composite material are cut in to small pieces and put in a solution of sodium chloride over a specific number of days. The change in weight is measured to determine the corrosion rate of the composite material.***
***Keywords: Aluminum 5083 alloy, Graphite, corrosion test.***

## I. INTRODUCTION

5083 aluminum alloy is an aluminum alloy with magnesium and traces of manganese and chromium. It is highly resistant to attack by seawater and industrial chemicals. Alloy 5083 retains exceptional strength after welding. It has the highest strength of the non-heat treatable alloys, but is not recommended for use in temperatures in excess of 65°C. Graphite is added to this alloy to strengthen is mechanical properties as well as the chemical properties. Corrosion testing is fundamental to understanding how materials perform under simulated service conditions and can help to ensure that they will reach their projected design life.

## II. LITERATURE SURVEY

On the first paper author investigates increase in tensile strength, wet ability, reduces porosity and develops good bonding with Al2O3 by properties of stir casting in aluminum composite materials.[1] In this paper author found that an increasing of hardness and with increase in weight percentage of ceramic materials by varying weight fraction of SiC, graphite and aluminum[2] In this paper the author describes their studies about the effect of reinforcements on sliding wear behavior of aluminum matrix composites.[3] This paper focus on different dispersion methods, mechanism of strengthening, composites synthesized using graphite and its applications.[4].In this paper author discuss about Effect of ball milling on graphite reinforced Al6061 composite fabricated by semi-solid sintering. [5]. This paper the author represents the investigation of friction and wear behavior of hybrid aluminum.

## III. ALUMINIUM ALLOY 5083

5083 aluminum alloy is an aluminum with magnesium and traces of manganese and chromium. It is highly resistant to attack by seawater and industrial chemicals Alloy 5083 retains exceptional strength after welding. It has the highest strength of the non-heat treatable alloys, but is not recommended for use in temperatures in excess of 65°C

### *A. Composition of aluminum alloy 5083*

Table 1. Typical composition of aluminum alloy 6061

| Components | Amount wt% |
|---|---|
| Aluminum | Balance |
| Magnesium | 4 - 4.9 |
| Silicon | Max 0.4 |
| Iron | Max. 0.4 |
| Zinc | Max. 0.25 |
| Titanium | Max. 0.15 |
| Copper | Max 0.1 |
| Manganese | 0.4 - 1 |
| Chromium | 0.05-0.25 |
| Others, each | Max 0.05 |
| Others, total | Max 0.15 |

## IV. GRAPHITE

Graphite has remarkable mechanical properties, which makes it hypothetically a good reinforcement in metal composites. It also has exclusive optical and thermal properties, which make it striking filler for producing multifunctional composites especially in case of metal matrix composite due to its viability and outstanding mechanical properties. Graphite is one atomic layer thick sheet of carbon or film of carbon atoms. Due to their sp2- hybridized two dimensional honeycomb structure, low weight, thermal, electrical and mechanical properties, it has been attracted to worldwide. In fact, graphite has a number of unique properties, which makes future applications and it's also the strongest material ever measured; it's the stiffest material; it's the most stretchable crystal and most thermally conductive material

Table 2. Properties of Graphite

| Properties | Values |
|---|---|
| Electron mobility | 1500 cm2 V |
| Resistivity | 10-6Ω-cm |
| Thermal conductivity | 5.3 ×103 Wm-1K-1 |
| Elastic modulus | 0.5 – 1 Tpa |
| Coefficient of thermal expansion | 6×10-4/K |
| Tensile strength | 130 GPa |

## V. STIR CASTING

For manufacturing of composite material by stir casting knowledge of its operating parameter are very essential. As there is various process parameters if they properly controlled can lead to the improved characteristic in composite material. The important process parameters are

*1)* Stirring speed
*2)* Stirring temperature
*3)* Reinforcement preheat temperature
*4)* Stirring time (Holding time)
*5)* Preheated Temperature of Mould
*6)* Powder Feed Rate
*7)* Addition of Mg

## VI. PROCEDURE FOLLOWED

Aluminium Alloy was melted in a crucible by heating it in a muffle furnace at 800°C for three to four hours.
The graphite were preheated at 1000°C and respectively for one to three hours to make their surfaces oxidized.
The furnace temperature was first raised above the liquidus temperature of Aluminium near about 750°C to melt the Al alloy completely and was then cooled down just below the liquid us to keep the slurry in Semi solid state.
Automatic stirring was carried out with the help of radial drilling machine for about 10 minutes at stirring rate of 290 RPM. At this stage, the magnesium and graphite were added manually to the vortex

## VII. CORROSION TEST

For the corrosion test the composite material cut in to small piece of indefinite sizes and the initial weight measured. Then the material was kept in a solution of NaCl with two different concentrations for 96 hours and th weight is measured. From the results we concluded that the 5% graphite composite have advantage over the 10% graphite composite but not with a great margin.

Table 3. Corrosion test result

| S.NO | Composition | % of NaCl Solution | Time In hours | Initial weight | Final weight |
|---|---|---|---|---|---|
| 1 | Al5083+5% Graphite | 35 | 96 | 2.582 | 2.583. |
| 2 | | 75 | 96 | 4.783 | 4.785 |
| 3 | Al5083+10% Graphite | 35 | 96 | 2.264 | 2.267 |
| 4 | | 75 | 96 | 5.509 | 5.514 |

## VIII. CONCLUSION

Graphite can be successfully used as a reinforcing material to produce metal-matrix composite (MMC) component in Aluminium alloy 5083. It can be successfully replaceable in the place of conventional aluminium alloy 5083 which improve the mechanical properties and wear behavior. From the corrosion test we found that all the comosition managed to maintain its corrosion resistance but the 5% graphite composite had the advantage over the 10% graphite composite.

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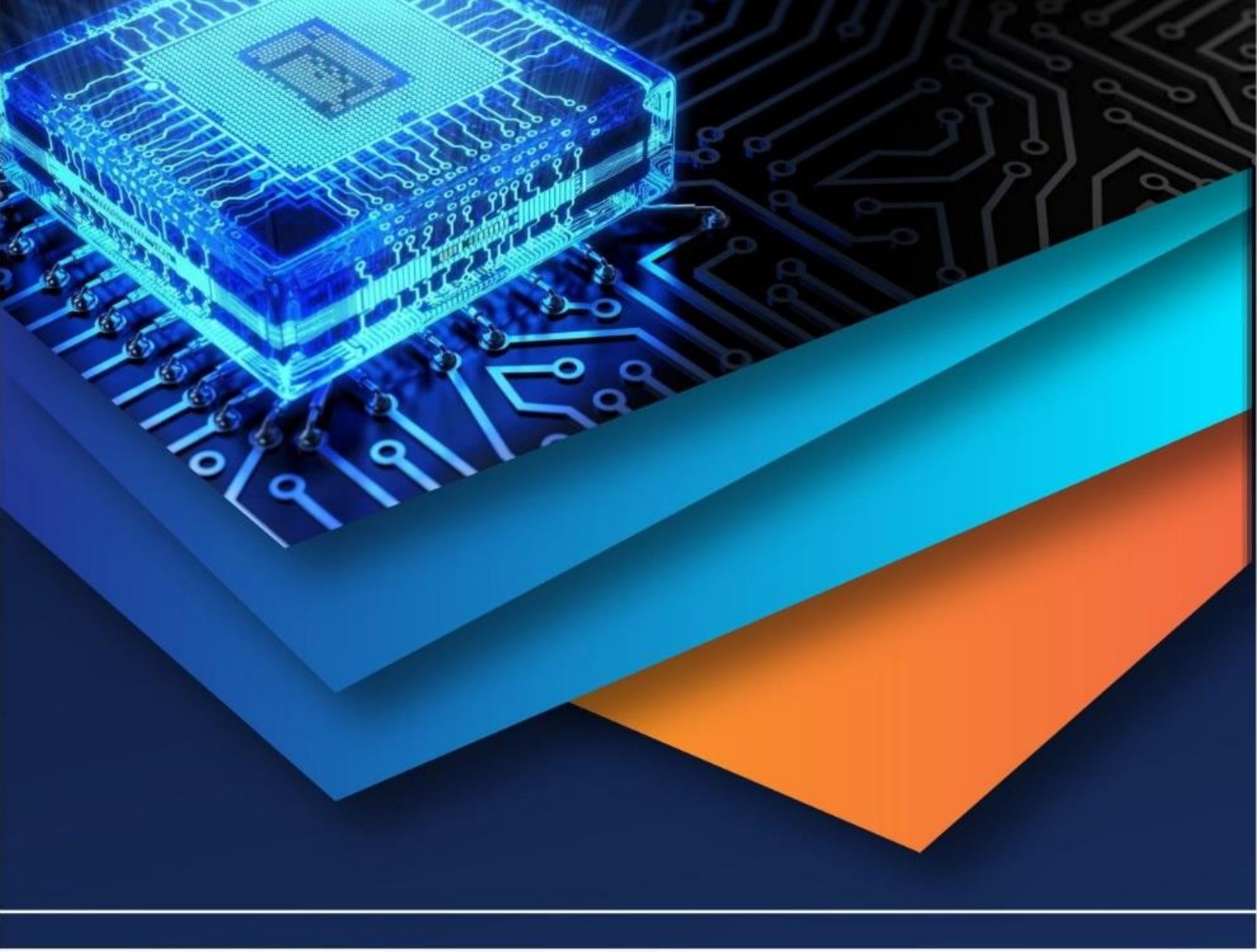

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