Determination of Corrosion Resistance Properties of Al-Sio$_2$ Composite Material

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Abstract. The Al-Sio$_2$ Composite work are widely used in engineering application in automotive industry in india and other countries. The Al-Sio$_2$ composite has been mainly used on high corrosion resistance material. The material used as a high thermal application also. Example boiler shield and engine shield also. The main performance of Al-Sio$_2$ material used in a corrosion resistance properties. Because the aluminum composite material when goes to the heat treatment application. The material was meeting in corrosion. In this way engineering industry was affected. So we are currently focused the work corrosion resistance application. In this work we have used for the Al-Sio$_2$ material was reinforced in aluminum 6061 material. The material was developed by stir casting method. The method the stirrer was run by 2000 RPM. And the material was molten by 550 degree temperature. That time the Al-Sio$_2$ powder was dropped by the molten metals. Hence the composite now formed by Al-Sio$_2$ composite material. After that we have checked by the SEM fractures and XRD measurement and other material properties also and also fracture surface of the materials. Finally we have concluded the result of work also.

Keywords: Al-Sio$_2$ Composite material, corrosion resistance material, Fracture surface, automobile application.

1. INTRODUCTION

The paper was studied the different weight percentage of composite sample as al sio2 material. The material was proposed by high corrosion and wear resistance properties. The manufacture method was stir casting method[1]. The paper was shown that the studied alumina composite materials as different wear resistance load properties. And the test was evaluated by Anova Method[2]. The paper was shown the molybdenum disulphide powders reinforced in aluminum alloy Al-2024. MOS2 powders of approximately 40 micro meter particle size were reinforced in an aluminum alloy matrix to produce composite sample of ratios, 1, 2, 3, 4 and 5% of

weight through stir casting technique. The result was evaluated in the corrosion and wear resistance properties.[3]. The paper was shown that the zirconium was doped in the aluminum alloy 7075 material. Hence the material has been higher corrosion and wear resistance was evaluated. The result was discussed in the paper.[4]
Aluminium alloy (LM6) and SiC, Fly ash has been chosen as matrix and reinforcing material respectively. Experiment has been conducted by varying the weight fraction of fly ash (55 and 15%). The result shown that the increase in addition of fly ash increases the tensile strength, impact strength, wear resistance of the specimen and decreases the percentage of elongation.[5] in this work glass particulate was doped in the al 6061 material. The material was developed by stir casting method. The material was carried out various test like mechanical test. And finally the sample was evaluated in wear properties also [6].in the sample test was carried out different samples was dooping with fly ash. The fly ash sample was evaluated in high corrosion and wear resistance properties. The sample was carried out corrosion resistance properties also. The sample was shown that high corrosion resistance properties[7]. The paper shown that hybrid metal matrix composite material in the mean of al 6061 material. The sample was showed that the high abrasion wear resistance properties also.[8]. In the wok was worked in the aluminum with Tic composite. The composite material was shown that high wear resistance and excellence corrosion resistance of the samples[9]. This paper investigates the mechanical properties and corrosion behavior of Metal Matrix Composites prepared using AL6061 alloy as a matrix, Silicon Carbide and Titanium Carbide as reinforcement particles. Two step stir casting process was used to fabricate the composites by varying volume fractions of Silicon Carbide and Titanium Carbide (0 to 15 vol. %).[10]

2. MATERIALS AND METHODS

2.1 Materials

In this work we have used for the Al-Sio_2 material was reinforced in aluminum 6061 material. The material was developed by stir casting method. The method the stirrer was run by 2000 RPM. And the material was molten by 550 degree temperature. That time the Al-Sio_2 powder was dropped by the molten metals. Hence the composite now formed by Al-Sio_2 composite material. After that we have checked by the SEM fractures and XRD measurement and other material properties also

2.2 Scope for Silicon di-Oxide as reinforcement

Figure 1. SEM Image of the Powder Particles

The powder SEM was Shown in Figure 1. And the SEM instrument was shown in Fig2. In this SEM image was taken by 250X magnification. The particle was shown in the image irregular shape. The shape was not given high ductiole properties but the material gives high corrosion resistance and high thermal application. Hence the Al-Sio_2 powder was measure the high thermal application and corrosion resistance material. The powder has been ball milling process. The process has gives micro to nano size of the material. Hence they will give better uniformity of the material.

2.3 X- RAY Diffraction of White Silica Sand

XRD test was shown in Fig 2. The test was carried out in a single XRD method. The 2 theta valve was developed as per jcpds software. The output was shown in figure. The figure was shown highest peack was SIo_2. Hence the material was used high corrosion and wear resistance was obtained.

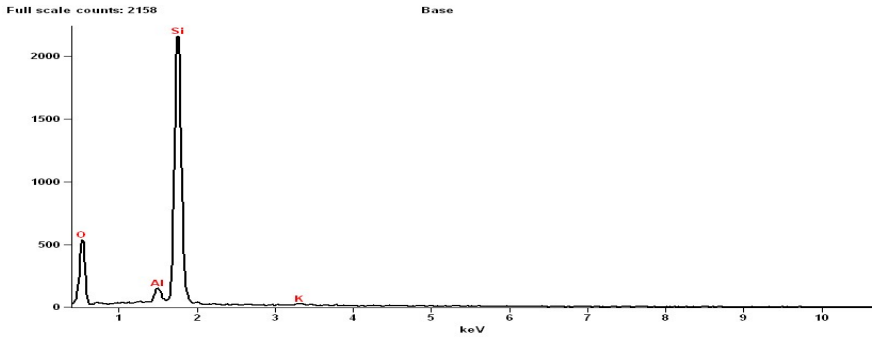

Figure 2. XRD Peacks in Sio2 Powders

2.4. Experimental Work

The Stir casting method was done by ultrasonic stir casting method. The ultrasonic stir casting method was working as a ultrasonic prob method. The molten metal was molted by 550 degree. That time the nano powder was poured in a molting part. Hence the cluster has been formed. That time the ultrasonic prob was break the cluster. Hence uniformly distribution was formed. The sem images was clarify the casitn images. The pouring temperature was maintained at 680ºC. The soften was then permitted to harden in the shape shown in the Fig.3

2.5. SEM Images of the Metal Matrix Composite

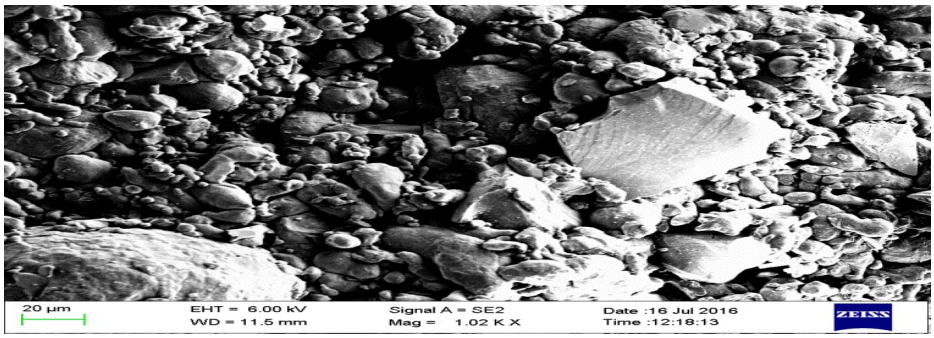

Fig.3 SEM image of Al- 5% SiO_2

The image of Al- 5% SiO_2 Metal Matrix Composite has been captured with the help of Scanning Electron Microscope at a Magnification of 1000 x with a resolution of 20 µm. From the image, it has been inferred blow-holes can be found at random but discrete locations, which acts as dislocations for the composite. These are so formed due to a meagre portion of Silicon di-Oxide particles which are geometrically skewed and resist to remain attached to the matrix. But, the blowholes are within the limit for effective usage of the material towards applications. This additionally incited to build the synthesis of SiO2 support in the Metal Matrix to Al- 10% SiO2 in a view to lessen the events of blowholes whose SEM image has been shown in the Fig.5 below.

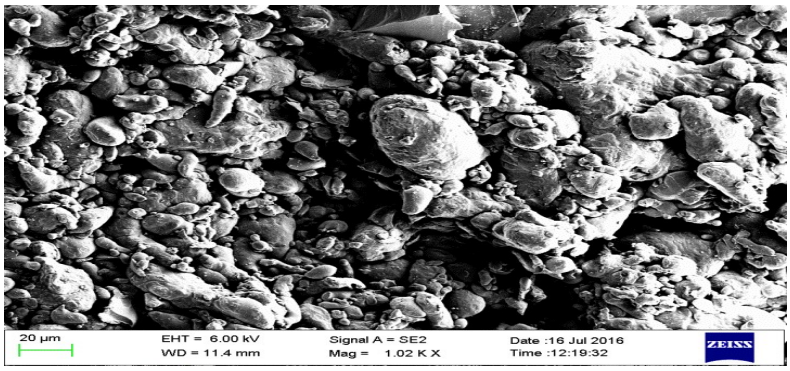

Fig.4 Scanned Electron Microscope picture of Al- 10% SiO_2

The Fig.4 above shows the Scanned Electron Microscope picture of Al- 10% SiO2 Metal Matrix composite. A significant part of the blow-holes that appeared in the Al-SiO2 structure has been evaded with the lobules being loaded up with overabundance SiO2 added. However, there envisioned some presence of breaks which could be a chance of immaterial disengagements that are expected to withstand flexible strain during stacking.

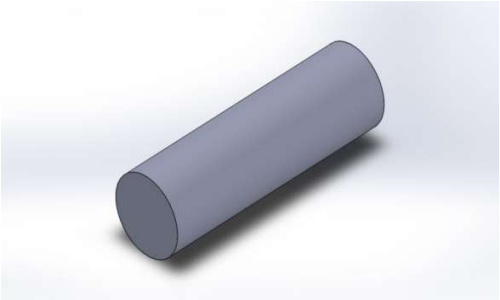

Fig.5 Metal Matrix composite Material Specimen- Simulated by CATIA Software

The mechanical properties of Metal Matrix composites involve its behavior under stress. Owing to control temperature and pressure, the material is cut such that mechanical properties fit to the ASTM standard which is tabulated in the Tables. CAD model shown in the Fig.5.

3. Mechanical Properties Observation

3.1. Tensile Test

The tensile test was measured by ASTM E8 Standards the testing specimen was cut by EDM process the testing sample was 58 MM length and 30mm gauge length area and 8 mm diameter. According to astm E8 standard specimen. The specimen was tested by UTM 5 Tone machine. The tensting result was discussion fig 9.

3.2 Hardness Test

The hardness test was measured by Rockwell hardness test. The test major load was given by 5 kg. minor load was given by 3 kg. The hardness was measured by HRB scale. The hardness valve was shown in digital dialer. The hardness was compared brinell and Vickers as per hardness charts. the hardness result was shown by 2

Fig 6. Hardness samples

3.3 Corrosion Test

The corrosion test was carrying out salt spray corrosion test chamber. The chamber was test by 5 litter Hcl solution. The hcl solution was prepared by 40 % hcl salt and 60% DM water. The solution was prepared by as per testing procedure. The water pressure was maintain by 4 bar pressure. The test was taken by 24 hours. After corrosion test was done the material was cut by corrosion layer with the help of EDM process. The layer was study the corrosion character station of the material.

4. RESULT AND DISCUSSIONS

4.1. Tensile Test

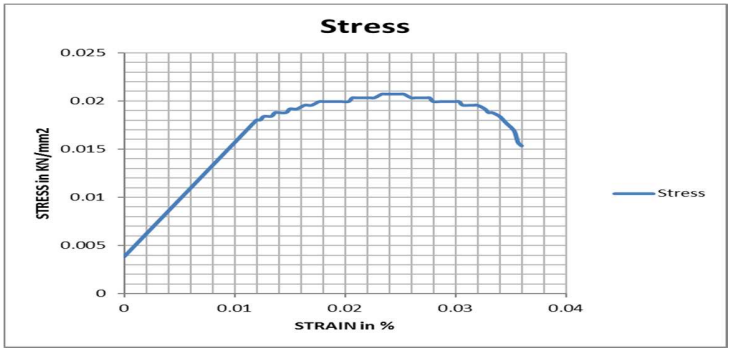

Fig.7 Stress vs Strain Curve

The above Fig.7 graph shows the curve shows that the tensile stress behaviours. The tensile stress has been shows that the ultimate break load as 0.54Kn. and the ultimate stress is 11.50 KN/mm$^{2.}$. The curve was shown in gradually increase the ultimate point and goes to the failure. The failure was shown that the brittle nature of the material in Fig9. The SEM image was shown in the poor distribution. Hence it was happen as a brittle nature. But it was used in a high compressive load and harness. It is used for high corrosion resistance

Table 1. Tensile tests results

Test Sample	Ultimate Breaking load (kN)	Ultimate stress (KN/mm^2)	Elongation in %	Displacement mm
1	0.54	11.50	4	0.7
2	0.76	14.62	4	1.0

Validation of % Elongation value:

% ELONGNATION = ORGINAL LENGTH -FINAL LENGTH/ORGINAL LENGTH

= 30-31.20/30*100

= 4 %

It is evident that the % Elongation in both the sample were 4% and the same has been validated from the calculation showed on theoretical basis.

4.2. Hardness test

Table 2. Hardness

Indentation Locations	HV of Al- 5% SiO_2 at 0.3 kg	HV of Al- 10% SiO_2 at 0.3 kg
1	30.2	31.4
2	31.4	33.0
3	33.4	32.9
4	30.6	32.0
5	32.8	32.5

The hardness value shown in the table. The table shows that the hardness valve was high. Because the material was happened in the tensile stress was high as well as normal sample. Hence the harness valve become high. The high hardness valve shows that the tensile sample also. The harness valve was proved that the brittle nature. The high harness valve has shown the high temperature application materials also.

4.3. Corrosion Test

The corrosion test image was shown in the figure 8. The figure has been shown that corrosion part. The corrosion resistance test was made in the corrosion chamber. The corrosion test was taken in 24 hours in corrosion chamber. The before corrosion resistance test the sample weight was 2.4 g/cm^2. After the corrosion resistance test the sample weight was 2.7 g/cm^2. Because the corrosion layer weight was added the sample . After that has been take the corrosion layer with the help of EDM process. The layer was studied in a SEM

Fig 8. Corrosion samples

5. Conclusion

- The conclusion was the current study obtained as follows
- The UTS valve was poorly dropped because when was added the Sio_2 material in the aluminum composite materials.
- The hardness valve was increased due to when added the aluminum oxide. It is also proposed the high compressive nature also.
- The corrosion resistance was studied. The corrosion resistance was improved up to 6 % /
- The wear resistance was taken in the sample as future work.

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