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Mechanical Behaviour Analysis of Al6061 Matrix and SiC – Kaolinite Reinforced Metal Matrix Composites Using Stir Casting

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Abstract:- This paper consider to learn about the mechanical properties of Aluminum Metal lattice composites. Aluminium is the most accessible material and its posses prevalent properties, for example, solidness, low weight, wear and erosion obstruction and also used to various applications in automobile body parts and engine parts. In this project work, Al6061 is constant and other the reinforcements SiC and Kaolinite in varying weight percentages, were fabricated the metal grid composites utilizing mix throwing process. Finally, to describe its mechanical properties are Tensile quality, Compression and Microhardness of the readied composites were dissected.

Keywords:- *Metal Matrix composites, Stir casting, SiC, Kaolinite, erosion obstruction.*

I. INTRODUCTION

Presently a day with the modern development need of developments of advanced engineering materials for various engineering applications goes on increasing. Metal matrix composites (MMCs) are light weight structural materials used in automobiles, aircraft, helicopters and spacecraft. MMC materials comprise of hard fortifying particles inserted inside a metal lattice stage. The matrix of MMCs is usually a low density metal alloy (e.g. aluminium, magnesium or titanium). Aluminium alloy composites posses excellent properties as lighter in weight, low cost and easy of fabrication have the potential to replace other costlier material in many significant engineering applications [1].

High solidarity to weight proportions, improved mechanical and warm properties, make metal matrix composites (MMCs) alluring for car applications. Silicon carbide (SiC) is made out of tetrahedral of carbon and silicon molecules with solid bonds in the precious stone grid. This delivers an exceptionally hard and solid material. SiC isn't assaulted by any acids or soluble bases or liquid salts up to 800 °C [2]. SiC and kaolinite molecule strengthened Al based MMCs are among the most well-known MMC and accessible ones because of their affordable creation.

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Kaolinite are lower in thickness and high hardness than silicon carbide, therefore a decent support type for superior MMCs. Kaolinite were initially heated at around 800°c. Hence for the preparing of aluminum lattice composites, mix throwing strategy is generally conservative than powder metallurgy process [3].

II. EXPERIMENTAL SETUP

➢ *Material choice*

Al 6061 was picked as the matrix metal and the other silicon carbide (SiC) and kaolinite as the fortifications.

In this work, an endeavor has been made to create aluminum (Al-6061)/SiC (Silicon carbide)/ (kaolinite) MMCs by Stir casting process.

Sample No	Al6061 (Wt %)	SiC (Wt %)	Kaolinite (Wt %)
1	90	7	3
2	90	4	6
3	90	2	8

Table 1:- Composition of tables

➢ *Fabrication of Al6061–SiC– kaolinite AMC by stir casting*

Stir casting is one of the novel techniques to deliver metal matrix composites with increasingly uniform appropriation of lattice and support constituents. This methodology includes mechanical blending of the fortification particulates/particles into a liquid metal shower. Stir Casting is the least complex and the most financially savvy technique for fluid state creation. In stir casting we use stirrer to agitate the molten metal matrix.

In this work, the manufacture of Al 6061, silicon carbide and kaolinite composites were completed by stir casting strategy.

The experimental setup of stir casting is used to fabricate of these composites was appeared in figure-I. Silicon carbide particles and kaolinite were at first warmed at around 800°C for 1 hrs to make their surfaces oxidized (pre – heated). Al 6061 combination billets were taken into a graphite pot and softened in an electrical furnace of respective temperature.

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The preheated SiC and Kaolinite particulates of varying compositions are shown in table-1, were included and blended in with mechanical mixing at 300rpm for 5 minutes.

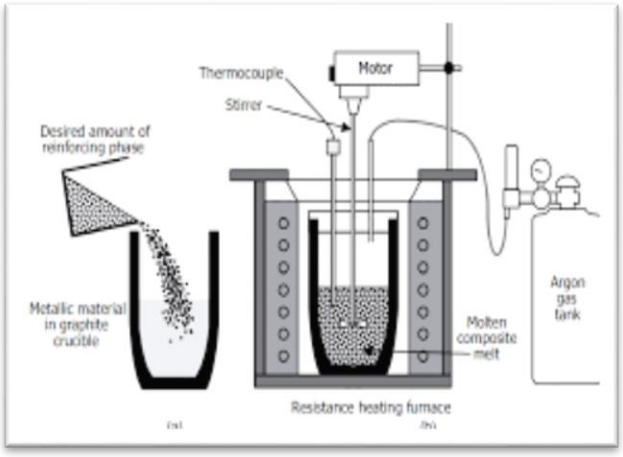

Fig 1:- Stir casting process

The last temperature of the composite was controlled to be around 750°C.

After stirring the melted composites was filled molds of bites the dust are made from cast steel and then permitted to cool with water to get cast plates.

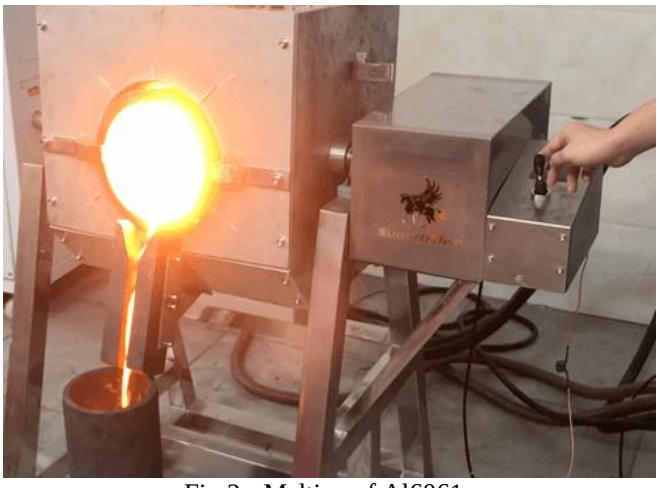

Fig 2:- Melting of Al6061

First of all, Al6061 was melted in a furnace at a respective temperature. Then the preheated fortifications can be added to the liquid metal and there stirring to the metal matrix composites. The blend was precisely mixed utilizing an engine of around 300rpm for 5 minutes before filling the form.

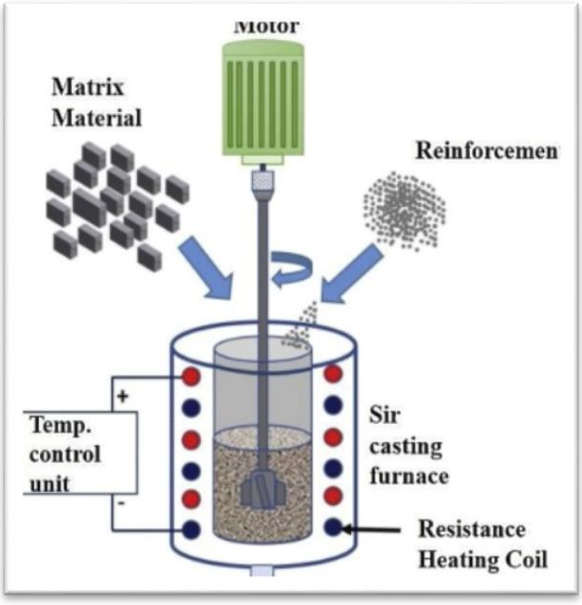

Fig 3:- Addition of reinforcements

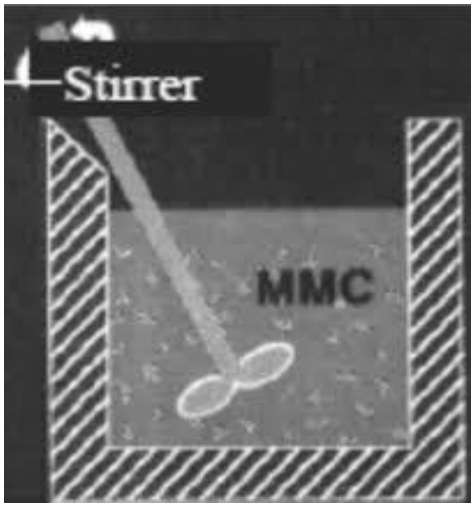

Fig 4:- Stirring of MMCs

Fig 5:- Pouring of molten Al into mould

Finally, AMC blend was filled the form and then permitted to cool with water to obtain cast plates.

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Fig 6:- Composite material

III. RESULTS AND DISCUSSION

A. Tensile test

A tensile test, otherwise called a tension test, is one of the most crucial and basic kinds of mechanical testing. A tensile test applies elastic (pulling) power to a material and measures the example reactions to the pressure.

Tensile test helps to deciding the adequacy and conduct of a material when an extending power follows up on it. These tests are done under ideal temperature and weight conditions and decide the most extreme quality or burden that the material can withstand.

Fig 7:- Specimen for tensile test

Thickness – 13.61 mm
Width – 11.90 mm
Gauge length – 50.00 mm
Final gauge length – 51.02 mm

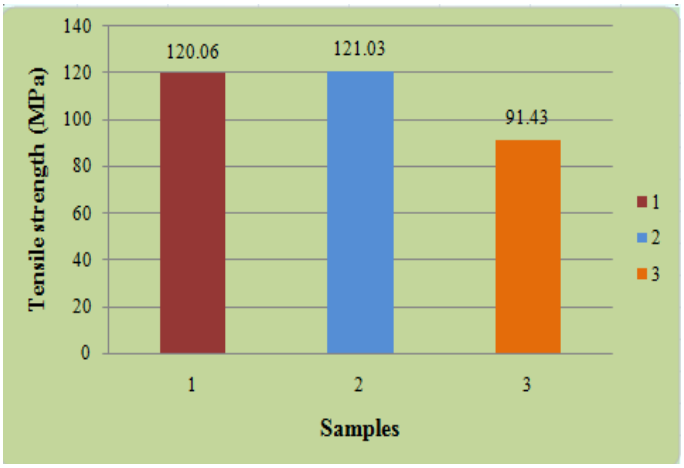

Fig 8:- Result of Tensile test

The measured tensile test results of the SiC and kaolinite reinforcement with Al6061 composites are shown in the Fig-7. With increment in extent of SiC and Kaolinite fortification has comparatively decreased. The experimental testing results are given in the Fig-8.

B. Compression test

To conduct the compression test on a machine (UTM). To decide a definitive compressive quality of the material. At the point when a material is exposed to compressive stacking, the connection among anxiety.

Fig 9:- specimen for compression test

Aluminium content of various proportions with SiC and kaolinite and their composites are shown in Fig-9.

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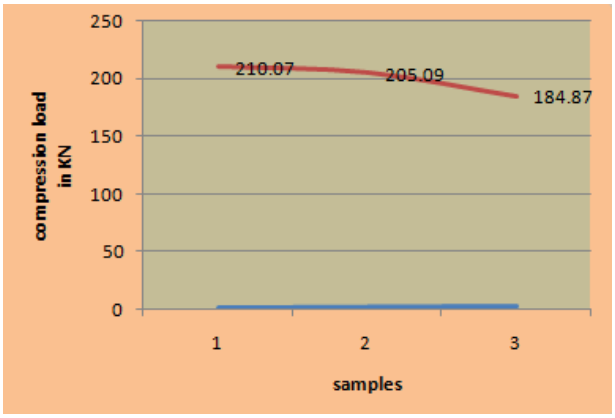

Fig 10:- Result of compression test

The measured compression test results of the SiC & Kaolinite reinforcement with Al6061 based hybrid composites are shown in Fig-10.

C. Hardness Test

The surface hardness of Al6061, Sic and Kaolinite reinforcement composites can be measured by vicker's hardness. With increment in proportions of SiC and Kaolinite support the VHN has relatively expanded. The test results of SiC and kaolinite reinforcement composites are shown in Fig-11.

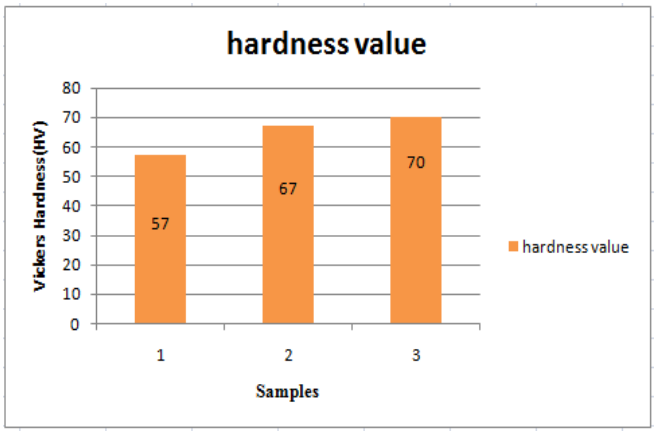

Fig 11:- Result of hardness test

The specimen having maximum vicker's hardness exhibits better hardness due to increasing the kaolinite of different weight percentages.

IV. CONCLUSION

This work shows that, the Al6061 reinforcement composites can be effectively manufactured by utilizing stir casting procedures. In light of the analysis of trial results, Tensile quality, compressive strength and hardness attributes were examined.

From the outcomes, kaolinite reinforced AMCs showed better hardness. The kaolinite content increases its increases the hardness strength than unreinforced Al.

REFERENCES

[1]. H.C.Anilkumar, H.S.Hebbar and K.S.Ravishankar, "Mechanical properties of fly ash reinforced Aluminium Alloy(6061) composites".
[2]. Sandeep kumar Ravesh, Dr.T.K.Garg, "Preparation & Analysis for some mechanical property of Aluminium based metal matrix composites reinforced with SiC and Flyash".
[3]. Rajeshkumar Gangaram Bhandare,Parshuram M.Sonawane, "Preparation of Aluminium matrix composite by using stir casting method".
[4]. Sato .A and Brotzen F.R, "Aluminium matrix composites: fabrication and properties", Metal. Trans.B, 1976,7,443.
[5]. Sharma S.C., Girish et,al; 'Effect of SiC particle reinforcement in Al6065 alloy'. Material Science 3151999:pp.183-189.
[6]. Radhakrishna, K. And Seshan, S. 'Application of chills for aluminium alloy castings', Trans.AFS,1981,89,158-169.
[7]. Meena KL, Manna A, Banwait SS, Jaswanti (2003) An analysis of mechanical properties of the developed Al/SiC mmc. American journal of Mechanicla engineering 1(1): 14-19.