Review On Characterization Of Hybrid Al Metal Matrix Composite Produced Through Stir Casting Technique

Noorullah D[1], Dr.K. Venkatesan[2], Dhilip Kumar B[3]
[1]Professor, Dept of Metallurgical Engineering
[2]Assistant Professor, Dept of Metallurgical Engineering
[3]Dept of Metallurgical Engineering
[1, 2, 3] Government College Of Engineering, Salem-11

Abstract- *In this Paper, a composite material containing Aluminium 7075 alloy (Al), Silicon Carbide (SiC) and Zinc Stearate are mechanically manufactured by method of stir casting. The process will start by melting Aluminium 7075 alloy with Silicon Carbide and Zinc Stearate and another composites is fabricate with Al 7075 alloy is reinforced using Silicon Carbide. The hardness test was made by Hardness testing method using Rockwell hardness on a prepared specimen. The tensile test and density test was made on the prepared specimen. The results of Al alloy, Al-SiC, Al-SiC-Zinc Stearate Composites are compared and the best composite specimen will be chosen.*

Keywords- Aluminium alloy, Composite, Stir Casting

I. INTRODUCTION

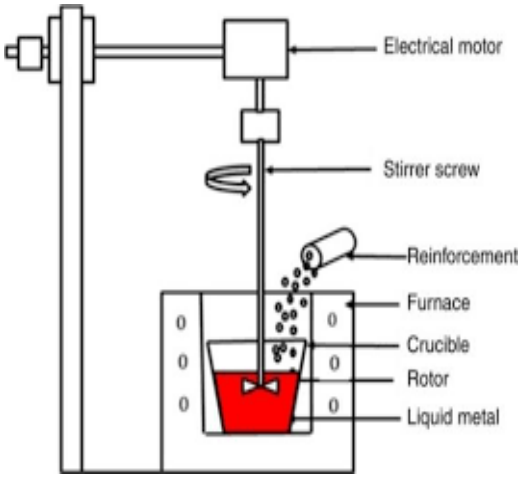
Literally the term composite means a solid material that results when two or more different substances, each with own characteristics are combined to create a new substance whose properties are superior to those of the original components for any specific application. The term composite more specifically refers to a structural material with in which a reinforcement material is embedded. And the engineering definition would also go along side-A material system composed of a mixture or combination of two or more constituents that differ in form or material composition and air essentially insoluble in each other. In principle, composites can be fabricated out of any combination of two or more materials-metallic, organic, or inorganic; but the constituent forms are more restricted. The matrix is the body constituents, serving to enclose the composite and give it a bulk form. Major structural constituents are fibres, particulates, laminates or layers, flakes and fillers.

II. STIR CASTING PROCESS

The above processes are most important of which liquid metallurgy technique has been explored much in these days. This involves incorporation of ceramic particulate into liquid aluminium melt and allowing the mixture to solidify.

Fig.1.1 Stir Casting Setup

Ceramic particles and ingot-grade aluminium are mixed and melted. The melt is stirred slightly above the liquid us temperature (600- 700 ˚c). The figure 1.1 shows the stir casting setup. Stir casting offers better matrix particle bonding due to stirring action of particles into the melts. The recent research studies reported that the homogeneous mixing and good wetting can be obtained by selecting appropriate processing 15 parameters liking stirring speed, time and temperature of molten metal, preheating temperature of mould and uniform feed rate of particles. Disadvantages that may occur if the process parameters are not adequately controlled include the fact that non homogeneous particle distribution results in sedimentation and segregation.



III. LITRATURE REVIEW

Mohammed Imran, A.R. Anwar Khan[1] et al ,This review presents mechanical and tribological properties of AMMCs containing single or multiple reinforcements. Fabrication was done by using stir casting method. Addition of Al2O3 (alumina) as reinforcement to aluminum alloy gives an improvement in its mechanical and tribological properties. Graphite reinforcement improves the machinability of aluminum and acts as self-lubricating property. Si-C particles show higher hardness of aluminum. Organic agricultural wastes utilized for reinforcement are fly ash, bagasse ash and coconut ash helps to improve the tensile strength, yield strength, etc. These studies were clearly discussed as follows.

Saikeerthi.S.P, Vijayaramnath.B,Elanchezhian.c[2] et al (2014) Aluminium matrix composite is a material with two constituent parts, one being a metal, other being reinforcement. Aluminium 6061 alloy is chosen a one of the constituent parts, which has good mechanical properties and exhibit good weld ability. The optical micro graphic study and XRD analysis and reveal the presence of B_4C particles in the composite with the homogeneous dispersion.

Viney Kumar Rahul Dev Gupta N K Batra[3] et al (2014),The effect of rpm on specific wear rate and comparison of mechanical properties of two metal matrix composites have been investigated. It was found that tensile strength increase with addition of fly ash. Similarly, when graphite was added then a decrease in tensile and hardness was observed. This is due to excess amount of Hardness is increased with the concentration of silicon carbide but sometime decreased due to porosity occurs during casting. Ultimate tensile strength with increasing in silicon concentration in the composite.

Bharath V, Madev Nagaral, V Auradi and S.A.Kori [4] et al (2014) Reinforcement particles were preheated to a temperature of 2000˚C and then dispersed in steps of three into vortex of molten Al 6061 alloy to improve weldability and distribution. Hardness and tensile properties of the prepared composite were determined before and after addition of Al_2O_3 particulates to note the extent of improvement. The hardness of the prepared composite increases with weight percentage of Al_2O_3 particulates and strength of prepared composite both tensile and held was higher in case of composite.

Kenneth Kanayo Alaneme, Michael Oluwatosin Bodunrin, Adebimpe A. Awe [5] et al (2016) The mechanical properties of aluminium hybrid composites reinforced with groundnut shell ash (GSA) and silicon carbide was investigated. GSA and silicon carbide with different mix ratios (10:0, 7.5:2.5, 5.0:5.0, 2.5:7.5 and 0:10) constituted 6 and 10 wt. The hardness increases with increasing the percentage of silicon carbide while the strength and hardness drops a little by increasing Groundnut shell ash. Percentage elongation improved marginally with increasing Groundnut shell ash content. The use of GSA as complementing reinforcement is viable for the production of low-cost high performance aluminium matrix composites.

Kenneth Kanayo Alaneme, Joshua Ogheneakporobo Ekperusi and Samuel Ranti Oke.[6] et al (2016) The corrosion behaviour of aluminium hybrid composites reinforced with rice husk ash and silicon carbide subjected to thermal cycling has been investigated. Aluminium hybrid composites having 10 weight percentage reinforcement consisting of silicon carbide (SiC)

Rama rao[8] et al examined that aluminium-silicon carbide were fabricated by stir casting with different particulate weight fraction (2.5, 5, 7.5) . Phase identification was carried out by on silicon carbide by X-ray diffraction studies microstructure analysis was done with SEM a composite were characterised by hardness and compression test. The result shows increase in amount SiC. The density of composite decreased where as the hardness is increased. The compressive strength of composite was increased with increase in the weight percentage.

Mohammed Imran, A.R. Anwar Khan [7] et al This review presents mechanical and tribological properties of AMMCs containing single or multiple reinforcements. Fabrication was done by using stir casting method. SiC particles show higher hardness of aluminum. Organic agricultural wastes utilized for reinforcement are flfly ash, bagasse ash and coconut ash helps to improve the tensile strength, yield strength, etc. These studies were clearly discussed as follows.

B.Veereshkumar [8] et al (2010), analyzed the physical and mechanical properties of Al7075-Al2O3 and Al6061-SiCcomposites. He manufactured Al7075-Al2O3 and Al6061-SiC (Al2O3, SiC particle size 20 μm) composites by liquid methodology technique. The test for density, hardness and tensile were carried out as per ASTM standards. He observed the tensile strength of the composites are higher than that of their base matrix Also he observed that the tensile strength of the Al7075-Al2O3 composites is higher than that of the composites of Al6061- SiC.

Muhammad Hayat Jokhio [9] et al (2010), investigated the mechanical properties of 7xxx aluminum matrix reinforced with alpha "Al2O3" particles using simple foundry melting alloying and casting route. He manufactured 5 different

combination of matrix alloys(Cu-Zn-Mg) reinforced with Al2O3 particles in 4 weight percentage (2.5,5,10 and 15). He observed that "Al2O3" particles up to 10% increase the tensile strength 297 MPa and elongation 17% in aluminum alloy matrix The higher tensile strength was obtained reinforced with 2.5% "Al2O3" particles. Aluminum cast composites up to 2.77% Mg contents which increases wetability, reduces porosity and develops very good bonding with "Al2O3" particles.

Hossein Bisadi [11] et al (2011), evaluated the mechanical properties of the Al7075/TiB2 Surface Composite fabricated by Friction Stir Process. The Vickers hardness of the stirred zone was measured on a cross section and perpendicular to the processing direction using a Vickers hardness tester. He observed highest micro hardness value is 179 HV when the tool rotation speed is 1115 rpm with the traverse speed of 60mm/min. The average hardness of as-received AL7075 alloy was 64HV. The tensile tests were carried out using a GALDABINI universal testing machine. He observed tensile tests also revealed that the addition of reinforcement significantly increased the yield strength of the composite from 91Mpa to 184Mpa.

Prabhakar Kammer [12] et al (2012), investigated the mechanical properties Al7075 with reinforced E- Glass (1%,3% and5%) and flyash (2%,4%,6% and8%) hybrid metal matrix composite fabricated by liquid methodology method. The specimen were conducted the tensile test and compressive strength. He observed increase in UTS due to presence of Eglass fibre and Fly ash as compared to base metal and composite was able to take more compressive load due to presence of E-glass fibre and Fly ash the compressive strength increased. He found Tensile strength and Compression.

Deepak Singla [13] et al (2013), reinforcement the fly ash in AL7075 alloy different volume fraction, Al7075 500g reinforcement fly ash 10gm,20gm,30gm and 40 gm. This composite produced by stir casting method and analyzed the physical and mechanical properties of composite. He observed the composite material density had reduced compared the base alloy.

Kumar [14] et al (2013), investigated the specific wear rate of Al 7075 with SiC (7 wt.%) and graphite (3 wt.%) hybrid aluminum metal matrix composite fabricated by using stir casting method. The unlubricated pin-on-disc wear tests were conducted to examine the wear behavior of the composites.

Arjun Haridas [15] et al (2013), Analyzed the mechanical behaviors of Al7075-reinforcement with SiC and Ni composites fabricated by stir casting method. The specimen carried the XRD test, Optical Microscopic Test and Rockwell Hardness test. He observed hardness of the matrix material Al7075 has improved by added reinforcement material Sic and Ni. The matrix and reinforcement material are well mixed by the stir casting and gives the better material profile.

T Senthilvelan1 [16] et al (2013), investigated mechanical properties of Al 7075-SiC, Al 7075-Al2O3, Al 7075-B4C composites fabricated by stir casting method. Tensile strength Al/B4C offers 143% improvement, Al/Al2O3 offers 88% improvement and Al/SiC offers 46% improvement. He concludes among the three MMCs, Al/B4C showed the strongest bonding as revealed by the good mechanical properties.

S. Gopalakannan [17] et al (2013), fabricated metal matrix nano-composite (MMNC) of Al 7075 reinforced with 1.5 wt% SiC nano-particles was prepared by a novel ultrasonic cavitation method. The hardness of the samples was measured using a UHL Vickers micro hardness measuring machine by applying a load of 0.5 kg and this load was applied for 20 s yielded 134.1 HV. The nano-composite of 1.5 wt% SiC offers ultimate strength and yield strength of 290.278 MPa and 245.833 MPa respectively. He developed mathematical models and multi response optimization for fabrication and machining aspects.

A. Baradeswaran [18] et al (2014), investigated the mechanicaland tribological properties of Al 7075/Al2O3 hybrid composite. He prepared Al 7075 with 5 wt.% graphite particles addition and 2, 4, 6 and 8 wt.% of Al2O3 . The hardness measurements were carried out on a Brinell observed wear rate decreases with the addition of Al2O3 and reaches a minimum at 2 wt.% Al2O3/ 5 wt.% graphite and it is about 36% less than that of the matrix material .

Raghavendra N [19] et al (2014), Studied the effect of particle size and weight fraction of Al 7075- Al2O3 composites in varying particle size of 100,140 and 200 mesh & varying reinforcement weight fractions of 3%,6%,9% and 12% by stircasting process route. He observed highest wear rate is obtained for the lower particle size. The 12% reinforced MMC indicates improved wear rate and lower speed the wear rate was significantly higher due to more contact area and high friction.

A Sert [20] et al (2014), Analyzed the wear behavior of Al7075 – SiC surface composite produced by Friction Stir Processing method. The test conducted at room temperature using loads of 2 ,4 and 5N, at a speed of 2.5cm/s, at a distance of 20m. He observed wear characteristic of surface composite

obtained by FSP method improved compared with main material. The rate of wear increased with an increase the load.

IV. CONCLUSION

This review presents the views, theoretical results obtained and conclusions made the recent years by varies investigators in the field of aluminum 7075 alloy Al7075-SiC (10%) and Al7075-SiC (10%)-Zinc sterate (5%) metal matrix composites are as follows, Al7075, Al7075-SiC (10%) and Al7075-SiC (10%)-Zinc sterate (5%) composites are successfully prepared using stir casting method. The microstructural studies revealed the fairly uniform distribution of the particles in all the three composites. Higher value of hardness was observed in composites when compared to matrix alone. Further, hardness of the Al7075-SiC (10%)-Zinc sterate (5%) composite increases with increasing amount of reinforcement. The addition of Tic and graphite has resulted in increases in tensile strength of Al7075 alloy when compared to unreinforced alloy. The tensile strength is a function of volume fraction of reinforcement. As volume fraction of reinforcement increases tensile strength of composite increases

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