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Study of Mechanical Properties of Aluminium Lm25 Stir Casting Method

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Abstract:
The present study deals with the behaviour of aluminium hybrid alloy based composites, reinforced with fly ash particles and solid lubricants such as activated carbon .The first one of the composites consists of Al. with fly ash particles and activated carbon. The other composite has Al with fly ash and solid lubricant: activated carbon at solid state. Both composites are fabricated through 'Stir Casting Method'. Mechanical properties of the samples are measured by usual methods such as Hardness,Tensile .The tested samples are examined using Scanning Electron microscope (SEM) for the characterization of microstructure on the surface of composites.

INTRODUCTION:

The ever-increasing demand for light weight, economy and environmental purpose has lead to the development of advanced materials . MMCs are widely used in industries, as they have excellent mechanical properties and wear resistance. So in this project introduced Particulate-reinforced hybrid composites because of it is cost less than fiber-reinforced composites owing to the lower cost of fibers and manufacturing cost. In addition to improved physical and mechanical properties, particulate-reinforced hybrid composites are generally isotropic and they can be processed through conventional methods used for metals. Thus, the fly ash ,aluminium LM 25 ,activated carbon reinforced with aluminum composites are increasingly used as substitute materials for high temperature applications.

Concrete and Material Company" in Jackson, Mississippi, formed by the company now known as "Dunn Investment Company" located in Birmingham. In1932 .1961 name changed to "Mississippi Materials Company" under President Ellis Hoff pauir. The field of Ai/SiC whisker composites began in the mid-1960s with the realization that whiskers or discontinuous fiber reinforcements can be competitive with continuous fibre reinforced material from the stand point of mechanical properties. In1981. Thereafter, began study on the machinability ofAl/SiC/Grp composites for their potential industrial application. Since then a good number of researches are being made to machine Aluminum metal matrix composite using various machining process in the practical material machining field.

In 2012 V. N. Gaitonde1, S. R. Karnik, M. S. Jayaprakash was conducted on the Some Studies on Wear and Corrosion Properties of Al /Al2O3/ Graphite Hybrid Composites an at-tempt has been made in the proposed work to study the effects of Graphite (Gr) and Aluminium oxide (Al2O3) on alu-minum hybrid composites involving both hard and soft reinforcements on wear and corrosion properties. The experimental results on Al5083-Al2O3-Gr hybrid composites revealed that the addition of reinforcement improves the hardness and reduces corrosion and wear rates. In 2012 Gheorghe IACOB, Gabriela POPESCU, Florin MICULESCU, Mihai, BUZATU production of Al/Al2O3/Gr powder composites using mechanical alloying the resulting products have low mechanical properties due to the structural un homogeneity of the obtained material.

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Aluminum, alumina and graphite elemental powders have been mechanically alloy. Powder mixtureswere mill for two hours Experiments indicate that this method is appropriate for obtaining composites with better homogeneity.

EXPERIMENTAL PROCEDURE FOR STIR CASTING:

SAMPLECOMPOSITIONS

SAMPLE	AL ALLOY LM 25 (%)	FLY ASH(%)	A.CARBON(%)
A	99	0.5	0.5
B	98	1	1
C	97	1.5	1.5

The conventional experimental setup of stir casting essentially consists of an electric furnace and a mechanical stirrer. The electric furnace carries a crucible of capacity 2kg. The maximum operating temperature of the furnace is 1900ºC. The current rating of furnace is single phase 230V AC, 50Hz. The aluminium alloy (LM25) is made in the form of fine scraps using shaping machine. It amounts to about 1150 gm. The metal scraps are poured into the furnace and heated to a temperature just above its liquidus temperature to make it in the form of semi liquid state (around 650ºC). The mixing of aluminium alloy is done manually for uniformity. Then the reinforcement powder that is preheated to a temperature of 600°C is added to semi liquid aluminium alloy in the furnace. Again reheating of the aluminum matrix composite is done until it reaches complete liquid state. Mean while argon gas is introduced into the furnace through a provision in it for few minutes.

During this reheating process stirring is done by means of a mechanical stirrer which rotates at a speed of 60 rpm. The aluminium composite material reaches completely liquid state at the temperature of about 950°C as the melting point of aluminium is 700ºC. Thus the completely melted aluminium metal matrix composite is poured into the permanent moulds and subjected to compaction to produce the required specimen.

SCANNING ELECTRON MICROSCOPE

A scanning electron microscope (SEM) is a type of electron microscope that produces images of a sample by scanning it with a focused beam of electrons. The electrons interact with electrons in the sample, producing various signals that can be detected and that contain information about the sample's surface topography and composition. The electron beam is generally scanned in a raster scan pattern, and the beam's position is combined with the detected signal to produce an image. SEM can achieve resolution better than 1 nanometer. Specimens can be observed in high vacuum, low vacuum and in environmental SEM specimens can be observed in wet condition.

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Fig SEM TEST SET UP

TESTING

HARDNESS TEST

The Vickers (HV) test was developed in England is 1925 and was formally known as the Diamond Pyramid Hardness (DPH) test. The Vickers test has two distinct force ranges, micro (10g to 1000g).

Fig 17-Hardness Testing Machine

The indenter is the same for both ranges therefore Vickers hardness values are continuous over the total range of hardness for metals (typically HV100 to HV1000). . With the exception of test forces below 200g, Vickers values are generally considered test force independent. In other words, if the material tested is uniform, the Vickers values will be the same if tested using a 500g force or a 50kg force.

Below 200g, caution must be used when trying to compare results.

TENSILE TEST

Tensile testing, also known as tension testing [1]is a fundamental materials science test in which a sample is subjected to a controlled tension until failure. The results from the test are commonly used to select a material for an application, for quality control, and to predict how a material will react under other types of forces. Properties that are directly measured via a tensile test are ultimate tensile strength, maximum elongation and reduction in area.[1]From these measurements the following properties can also be determined: Young's modulus, Poisson's ratio, yield strength, and strain-hardening characteristics.[1]Uniaxial tensile testing is the most commonly used for obtaining the mechanical characteristics of isotropic materials. For anisotropic materials, such as composite materials and textiles, biaxial tensile testing is required.

Fig UNIVERSAL TESTING MACHINE

BRINELL HARDNESS TEST

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Type of Test	Sample ID	Observed Value
Brinell Hardness Test	Sample A	(94.6)HBW
	Sample B	(96) HBW
	Sample C	(96.8) HBW
	Sample D	(96.3) HBW

Table Result of Brinell Hardness Test

TENSILE TEST

Sample Identification	Observed Value		
	Tensile Strength (N/mm^2)	Yield Strength (N/mm^2)	Elongation (%)
Sample A	277	275.7	18.2
Sample B	324	283	19.5
Sample C	316	279	18.4
Sample D	321	277	18.3

Table Result of Tensile Test

SEM TEST RESULTS

SAMPLE B ZOOM-x250

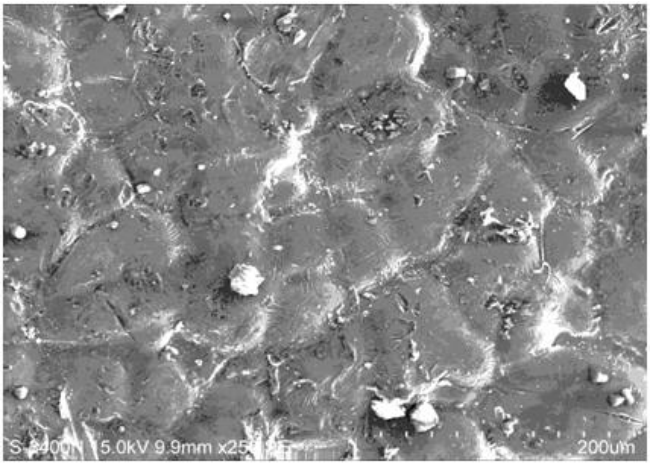

Fig Scanned Image of Sample A

SAMPLE B ZOOM-x250

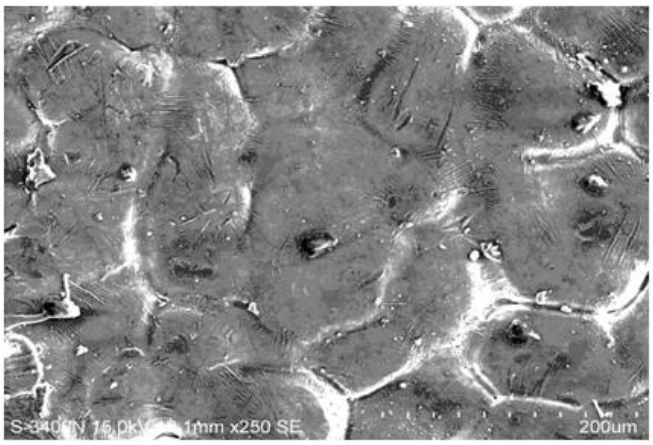

Fig Scanned Image of Sample B

SAMPLE D ZOOM-x250

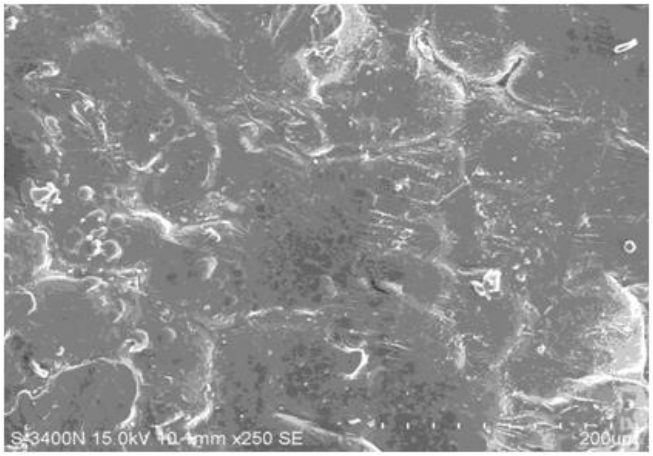

Fig Scanned Image of Sample C

CONCLUSION:

A Aluminium Hybird composites has been sucessfukly fabricated using two different reinforcements fly ash and activated carbon usinf stir casting techniques. Mechanical properties of the samples are measured by usual methods such as Hardness , Tensile .The tested samples are examined using Scanning Electron microscope (SEM) for the characterization of microstructure on the surface of composites..The test results shows its properties are better than the standard aluminium.

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