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Optimization and Prediction of Al(7075) metal matrix with Silicon Carbide, Fly Ash and E-glass Fibre

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Abstract

In the present scenario E-Waste is an important subject to solve and to utilize in a better way for the betterment of the human society. E-Waste mainly contains many useful materials such as aluminium, copper, lead, gold, etc. These materials are recyclable and can be utilized in making a better material composite by using a suitable reinforcement. Here study focused on the E-Waste like printed circuit boards which contains aluminium in its heat sinks. These heat sinks are made up of aluminium alloy specially from Al7075. Our study basically focused on Al7075 is taken as matrix material and reinforcement as fly ash and E-Waste. Here fly ash is varied with respect to weight percentage and E-Waste is kept constant with some weight%. After that the sample composite will be prepared by the stir casting method.

INTRODUCTION

Stir casting is a forming and fabrication technique. Aluminium has played a key role in the development of metal matrix composites (MMCs) reinforced with Bi and fly ash. The combination of light weight, environmental resistance and useful mechanical properties such as modulus, strength, toughness and impact resistance has made aluminium alloys well suited for use as matrix materials. Moreover, the melting point of aluminium is high enough to satisfy many application requirements. Bismuth is widely used because of its high modulus and strengths, excellent thermal resistance, good corrosion resistance, good compatibility with the aluminium matrix, low cost and ready availability.

MATERIAL SELECTION

ALUMINIUM:

Aluminium hybrid composites are a new generation of metal matrix composites that have the potentials of satisfying the recent demands of advanced engineering applications. This demand is met due to improved mechanical properties as discussed above. Current engineering application requires material that is stronger, lighter and less expensive. Also Aluminium strength to weight ratio which is best suitable for automobile application.

ALUMINIUM(7075)

BISMUTH:

It is a brittle metal with a silvery-white color when freshly produced, but surface oxidation can give it an iridescent tinge in numerous colours. Bismuth is the most naturally diamagnetic element and has one of the lowest values of thermal conductivity among metals.Bismuth particles when reinforced metal matrix composites have been considered as an excellent structural property in the automotive industry, because of their excellent combination of low density and high thermal conductivity

BISMUTH

FLYASH:

Fly ash is considered as one of the most important and advantageous waste material in construction industry. Fly ash (FA) is one of the cheapest available reinforcement. The advantages of using FA is the reinforcement due to its low density paves way for the development of effective AMCs.

FLY ASH

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E-WASTE:

If the aluminium scrap is properly recycled and purified it should be nearly 100% pure aluminium.

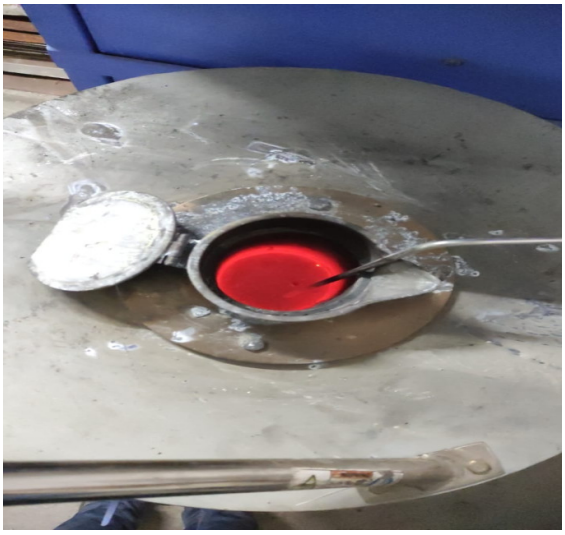
E-WASTE (Al SCRAP)

EXPERIMENTAL PROCEDURE:

We selected our materials first which is aluminium 7 series, bismuth, fly ash and E-Waste. In the help of materials stir casting process is used to find composite material and then got work piece it is used to stir casting process and finally testing the all work piece such as imapact strength, tensile strength and hardness test then finally got the result of composite material

STIR CASTING PROCESS:

Specimen	Percentage (%)				Grams(gm)			
	AL	Bi	Fly ash	E-Waste	AL	Bi	Fly ash	E-Waste
A	91	2	2	5	850	17	17	42
B	82	4	4	10	850	34	34	85
C	73	6	6	15	850	50	50	127



STIR CASTING:

Stir casting is a technique used to fabricate the powders of metals, alloys etc., in necessary quantities which are blended, pressed into desired shape(Compacted),and then heated(Sintered) in a controlled atmosphere to bond the contacting surfaces of the particles.

Compact load: 4.5tons

STIR CASTING MACHINING CENTRE

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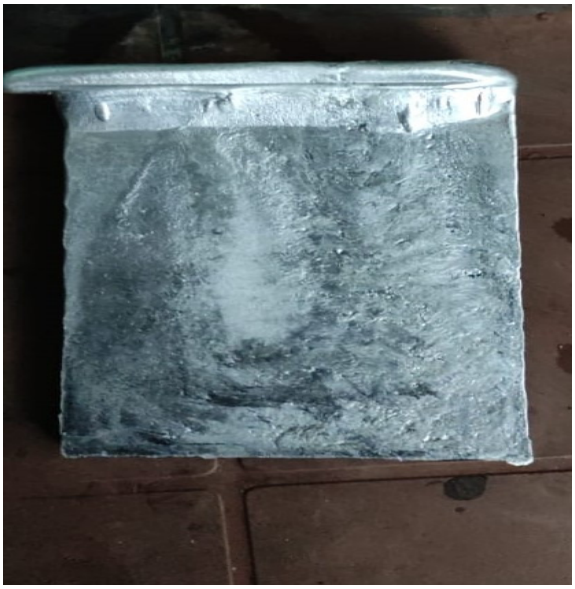
SAMPLE PREPARATION

The Al7075 has been cut in to pieces as per required weighted and melted in stir casting furnace at 1000 rpm. Then reinforcement materials also mixed to aluminium. Then the composite melted at 650 °C and the melted composite is transferred in to die and the work specimen is acquired.

Temperature at composite melted



Specimen

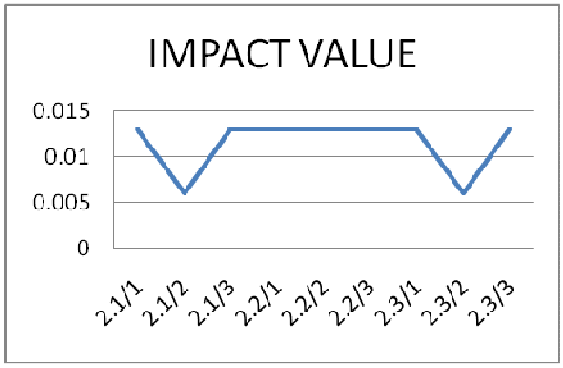
TESTING

IMPACT STRENGTH

Impact strength, is the capability of the material to withstand a suddenly applied load and is expressed in terms of energy. Often measured with the Izodimpact strength test or Charpy impact test, both of which measure the impact energy required to fracture a sample. TheCharpy impact test, also known as the Charpy V-notch test, is a standardized high strain rate test which determines the amount of energy absorbed by a material during fracture.

Impact strength value for Metal Matrix Composite

SAMPLE ID	IMPACT VALUE
2.1/1	0.013
2.1/2	0.006
2.1/3	0.013
2.2/1	0.013
2.2/2	0.013
2.2/3	0.013
2.3/1	0.013
2.3/2	0.006
2.3/3	0.013



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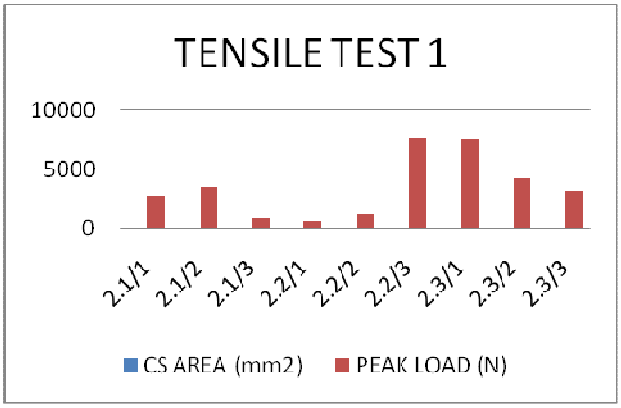
TENSILE STRENGTH:

Tensile strength, maximum load that a material can support without fracture when being stretched, divided by the original cross-sectional area of the material. . When stresses less than the tensile strength are removed, a material returns either completely or partially to its original shape and size. As the stress reaches the value of the tensile strength, however, a material, if ductile, that has already begun to flow plastically rapidly forms a constricted region called a neck, where it then fractures.

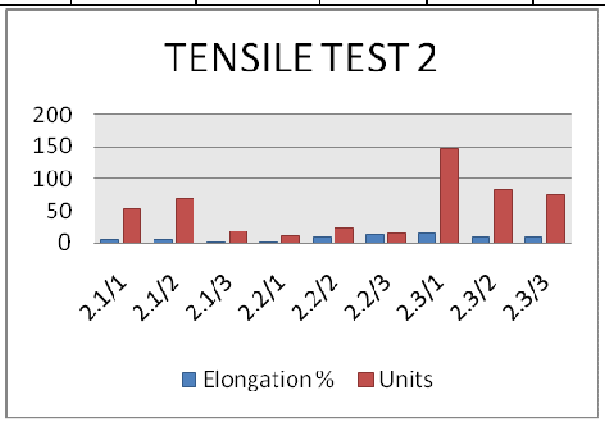
Tensile Strength Value For Metal Matrix Composite

SAMPLE NO	CS AREA (mm2)	PEAK LOAD (N)	ELONGATION%	UTS (N/mm2)
2.1/1	51	2806	5.92	55.02
2.1/2	51	3530	4.44	69.23
2.1/3	51	931.	1.52	18.27
2.2/1	51	565.	1.6	11.09
2.2/2	51	1245	9.08	24.43
2.2/3	51	7654	13.68	15.08
2.3/1	51	7500	15.2	147.0
2.3/2	51	4305	9.08	84.44
2.3/3	51	3210 .32	8.21	75.46

Analysis for Tensile strength



SAMPLE NO	HV1	HV2	HV3	HV4	HV5
1.1	98.1	105.9	106.5	88.1	88.2
1.2	93.7	100.2	98.6	105.2	102
1.3	87.5	81.5	84	78.1	82.1



HARDNESS STRENGTH

The hardness strength is an ability of the materials to withstand the resistance against the indentation or abrasion. It is tested by hardness testing machine, Hardness can be tested by the three types of hardness tester Brinell, Rockwell, and Vickers hardness testing machine. In this research the Brinell hardness testing machine is used to analyse the hardness strength of the sample. The ball type indenter tool is used. The hardness values are calculated using the formula which is mentioned below.

[1] SAMPLE NO	[2] ELONGATION%	[3] UTS (N/mm2)
[4] 2.1/1	[5] 5.92	[6] 55.02
[7] 2.1/2	[8] 4.44	[9] 69.23
[10] 2.1/3	[11] 1.52	[12] 18.27
[13] 2.2/1	[14] 1.6	[15] 11.09
[16] 2.2/2	[17] 9.08	[18] 24.43
[19] 2.2/3	[20] 13.68	[21] 15.08
[22] 2.3/1	[23] 15.2	[24] 147.07
[25] 2.3/2	[26] 9.08	[27] 84.44
[28] 2.3/3	[29] 8.21	[30] 75.46

$$BHN = \frac{2P}{\pi D(D-\sqrt{D^2-d^2})}$$

Hardness Value of Metal Matrix Composite

Analysis for Hardness strength

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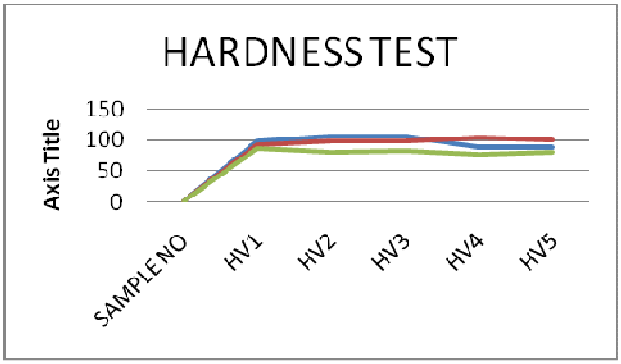

CONCLUSION

We choose aluminium MMC because of low cost to high weight ratio. Its reading available when compared to other metals and (AMC'S) plays a virtual role in our day to day life moist of the composites mainly considerers aluminium has a main matrix because of its excellent mechanical properties. It can satisfy the needs of high material and so it can easily replace the existing component with less weight. In Automobiles it is mainly used which will increase the millage due to weight reduction. The aluminium is the best Composite and in that we specifically select Al (7075). At present 8 series is also used for research works which will also enrich the properties of aluminium. Preparation of Al-Bi-Fly ash composites by Stir casting technique is attempted during this project work. Composites are prepared by varying volume of reinforcement. Compare with manual mixing of Powders, Magnetic Mixing of powders yields better hardness. It was found that a uniform distribution of Bismuth and fly ash in the Aluminium Matrix.

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