Study of the SEM&EDX analysis and mechanical properties of Impact test of Aluminum alloy LM12 /Sic metal matrix composites it's fabricated by stir casting Techniques

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Abstract**:** Aluminum metal matrix composites are broadly used in different application, because it contains greater mechanical and physical properties, compared to their base AL alloy. This paper centers around the change in mechanical properties of AL LM-12 when it is reinforced with SiC fabricated using stir casting method. For this reason AL LM-12 and reinforcement of SiC with various wt% utilized. SiC is reinforced in 5, 10, 15 and 20 wt. %. Impact of SiC reinforcement on AL LM-12 and its chemical properties like SEM/EDX is talked in detail

Keywords: *AL/SiC, AL LM-12 MMC's, Impact test and SEM&EDX*

1.Introduction

Metal matrix composites are obtained by reinforcement of ceramic particles to a base metal to realize improvements in properties (1-4). The reinforcements forms can be found in fibers, whiskers and particulates(6-8). To achieve the required properties of MMC-reinforcement material, fabrication method, varying percent and % volume can be followed to make it suitable of industrial use. Because of their superior strength and hardness metal matrix composites are replacing monolithic materials in aerospace as well as automobile industries. (9-12).

Present work describes the microstructural and mechanical properties of LM12 Aluminum alloy and silicon carbide MMC's reinforced with various %wt of SiC particles.

The matrix alloy LM12 employed presently for the development of the composite is an aluminum copper alloy. The composition of the alloy is as given below.

Element	Wt.%	Element	Wt%
Copper	09-11	Zinc	0.8 max
Magnesium	0.2-0.4	Lead	0.1 max
Silicon	2.5 max	Tin	0.05 max
Iron	1.0 max	Titanium	0.2 max
Manganese	0.6 max	aluminum	Balance
Nickel	0.5 max		

Table: 1.1 composition of the LM12 alloy

2.Experimental Procedures

As we know wear is process of removal of material eviction that usually occurs at outer surface of the material. In this experiment totally five specimens are prepared, at different wt % of Sic (% wt 0, 5, 10, 15 &20). Impact test is conducted both Izod and charpy machine

To analyses the SiC is uniformly distribution in the MMC's by using SEM machine and to analysis the semi quantities of Cu, Sic and Al in the MMC's by using the EDX machine.

Sl. No	Material	Impact Energy(U) In N-m			Impact Strength in Nm/mm^2
		Trail 1	Trail 2	Trail 3	
1	Pure LM12	12	12.2	11.8	0.171
2	LM12+ 5% SiC	9.5	9.2	9.8	0.136
3	LM12+ 10% SiC	8	7.6	8.4	0.114
4	LM12+ 15% SiC	6	5.5	6.4	0.0857
5	LM12+ 20% SiC	4	3.58	4.62	0.0571

Development of MMC's by using stir casting process

The specimens are prepared by using a stir casting process as shown schematically in Fig.3.1

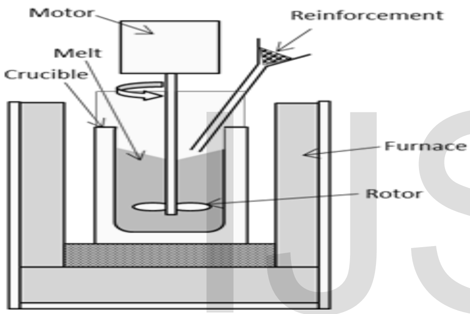

Fig:3.1

4.Impact test

4.1 Izod Impact Test


Fig:4.1 Impact machine for izod test


Fig:4.2 fabricated specimen

Dimensions of specimen

d = 7mm , $\theta=90^0$

3. b = 10 mm , $A=70mm^2$

Table:4.1

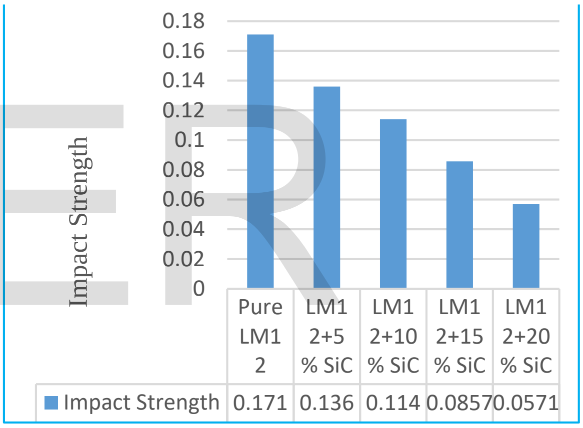

Fig:4.3

4.2 Charpy Impact Test

Fig:4.4 Charpy machine for izod test

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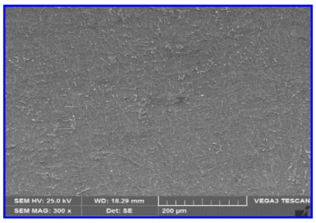
Fig:4.5charpy specimens

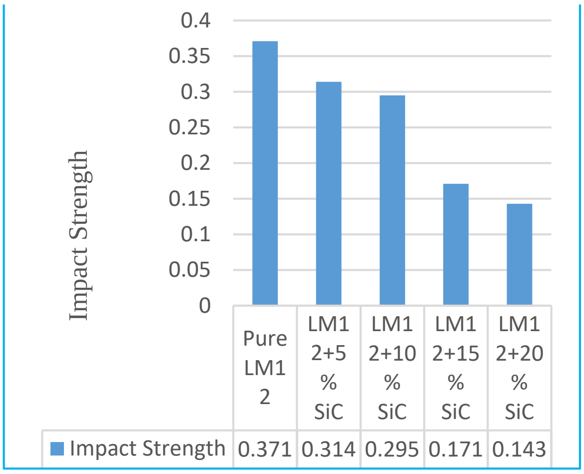


Dimensions of specimen

d = 7mm , $\theta=145^0$

b = 10 mm , A=70mm^2

Table:4.2



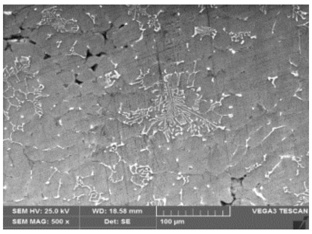
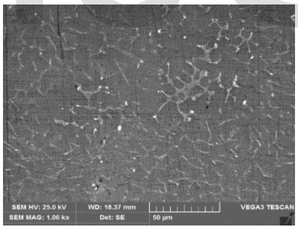


Fig:4.5

Engineering structures and machine components are subjected to different kinds of loads. Under the action of the applied load, materials deform (change its



shape/size), and this deformation can be temporary recoverable or of permanent nature.

5.SEM&EDX Testing Machine

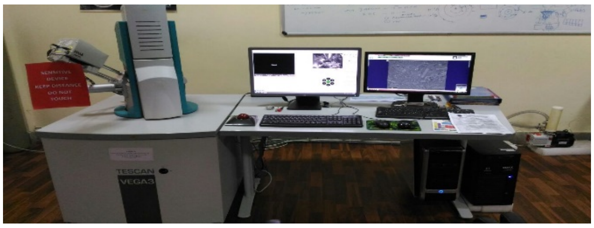
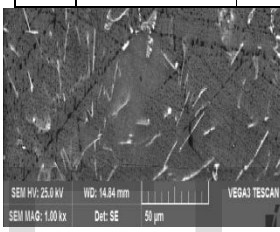


Fig:5.1 Testing machine

Fig:5.2 SEM/EDX Specimens

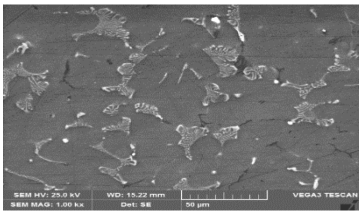
5.1Scanning Electronic microscopic (SEM)

Sl. No	Material	Impact Energy (U) in N-m			Impact Strength in Nm/mm^2
		Trail 1	Trail 2	Trail 3	
1	Pure LM12	24	28	26	0.371
2	LM12+5% SiC	19	17	18	0.314
3	LM12+10% SiC	24	28	26	0.295
4	LM12+15% SiC	11	13	12	0.171
5	LM12+20% SiC	10.5	9	10	0.143



LM12 LM12+5%SiC

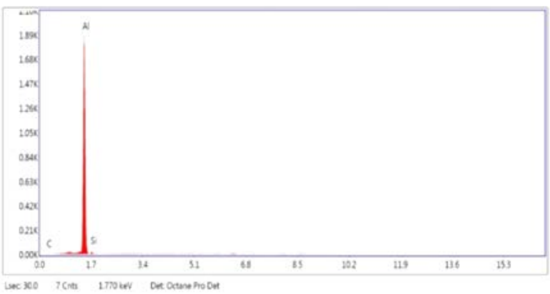
LM12+10%SiC LM12+15%SiC



LM12+20%SiC

Fig:5.3

5.2 Energy X-ray Dispersion (EDX)



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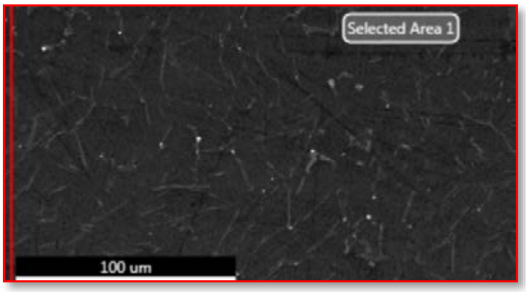
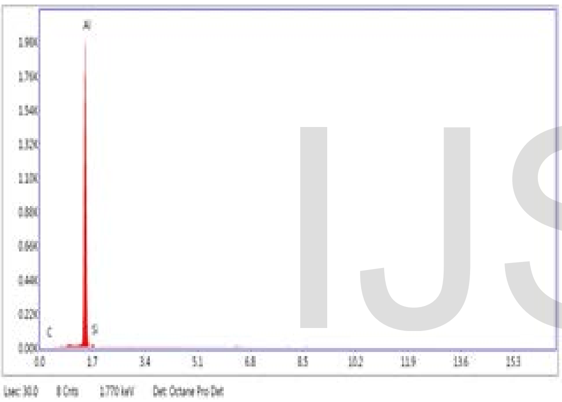
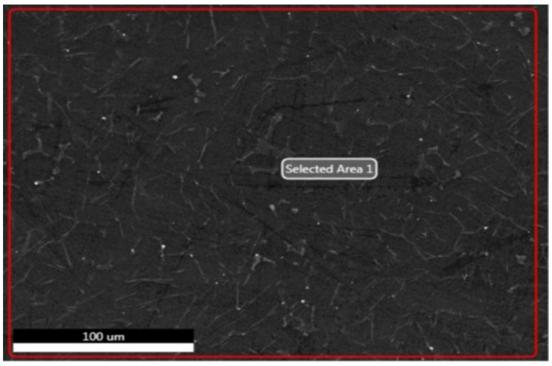
Element	Weight %	Atomic %
C K	3.32	5.08
Al K	95.81	94.3
Si K	1.87	2.62



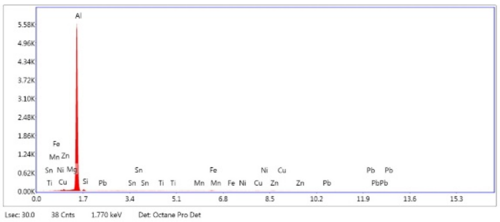
LM12

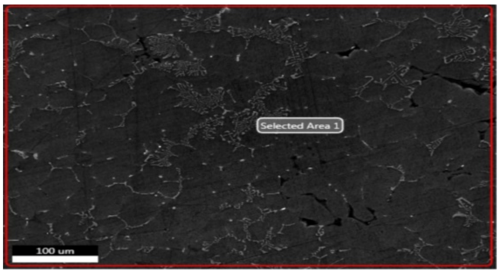




LM12+5%SiC

Element	Weight %	Atomic %
CuK	2.13	4.28
AlK	91.73	90.44
SiK	4.22	4.18

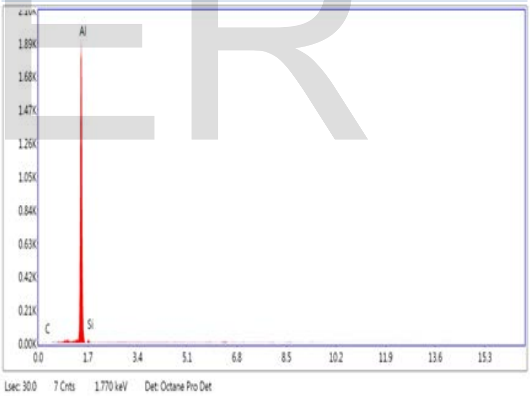


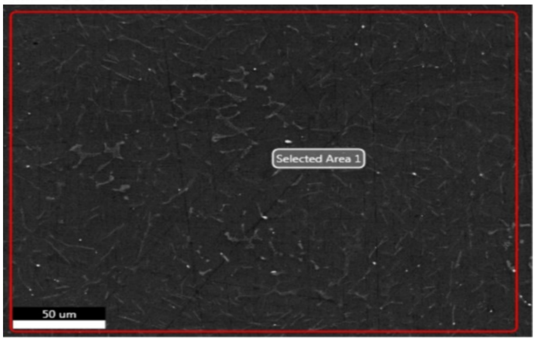


LM12+10%SiC

Element	Weight %	Atomic %
C K	2.32	5.08
Al K	93.81	91.3
Si K	3.87	3.62

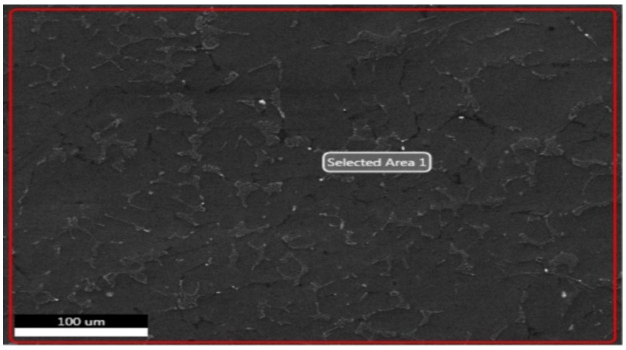
C K	1.41	3.12
AlK	91.42	92.89
SiK	4.87	5.15





LM12+15%SiC

Element	Weight %	Atomic %
C K	0.68	1.51
AlK	91.94	93.03
SiK	5.58	5.93



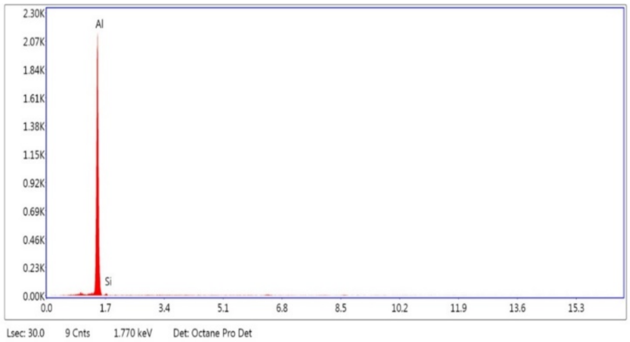
LM12+20%SiC

Fig:5.4

6. Results and Discussions

The impact test data shows the effects of silicon carbide (SiC) particles in as-cast product produced, the physical and mechanical properties measured includes, hardness values and impact energy. The results revealed that, addition of silicon carbide reinforcement, increased the hardness values and decreased the impact energy, the weight percent of silicon carbide increased in the alloy and this results effected to decreases the elasticity property of the alloy that variations shown in graphs fig(4.3and 4.5).

The scanning electron micrograph (SEM) data obtained from fig: 5.3 the base metal LM12 and its composite at 5%, 10%, 15% and 20%w SiC micrographs were displayed. Base alloy LM12 reveals Al matrix (light gray) with islands of silicon (dark gray). Composite of LM12 with 5%, 10%, 15% and 20%w SiC depict a similar base metal microstructure interspersed with fine particles (light grey) of SiC. Composite with 15% and 20%w reinforcement reveals dense dispersement of SiC than that with 5% and 10%w SiC.



The energy dispersive X Ray (EDX) spectral analysis data obtained from the fig: 5.4 base metal LM12 and its composites. Semi-quantitative spectral analysis is listed for elements aluminum, silicon and copper. The data reveal that the compositions of Al and SiC for the composite are almost matching the base metal (LM12). Enhancement of silicon content in the composites in contrast to base metal (LM12) may perhaps be attributed to Silicon pickup from SiC reinforcement. With increasing SiC content silicon pickup has also enhanced. This observation is commensurate with electron microscopic observations displayed.

wear rate decreases proportionally to the increases the Sic. Because material become more hard and brittle so wear resistance factors increases.

7. Conclusions

Composite of aluminum alloy LM12 and silicon carbide was successfully fabricated by using a stir casting techniques and tested. Microstructure of the composite revealed a fairly uniform distribution of silicon carbide in LM12 matrix.

The experimental analysis we can conclude that, the impact test, the load is increases of AL-LM12 MMC's the load absorption of MMC's is decreases with increase the SiC of wt % due to this brittle properties is increases.

The analysis of AL LM12 using the SEM methods, the uniformly distribution of SiC in the MMC's that can absorbed in the color of LM12 light gry and SiC of dark gray.

The experimental data analyzed with using of XRD methods, in this test absorbed the semi quantity of Al, Cu and SiC in the MMC's.

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