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EXPERIMENTAL STUDY ON THE EFFECT OF WEIGHT PERCENTAGE OF SIC ON THE ELASTICITY AND THE HARDNESS OF THE COMPOSITE MADE FROM AL AND SIC PRODUCED BY STIR CASTING.

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***ABSTRACT:** Now a days composite are having very wide range of application. Achieving a uniform distribution of reinforcement within the matrix is one such challenge, which affects directly on the properties and quality of composite material .In the present study a attempt is made to develop Aluminum based silicon carbide particulate MMCs with an objective to develop a conventional low cost method of producing MMCs and to obtain homogenous dispersion of ceramic material. To achieve these goals method of stir casting technique has been proposed and subsequent property analysis has been made. Aluminum 6061 in solid form and SiC in the powder form has been chosen as matrix and reinforcement material. Experiments are planned for conducting varying weight fraction of SiC (in the steps of 5%) while keeping all other parameters constant. As an outcome it has been found that the elasticity property decreases as the weight percentage of the SiC increases and as the weight percentage of SiC increases the hardness of the composite increases.*

KEYWORDS: **Aluminum 6061, Elasticity, Hardness, MMC (Metal Matrix Composites), SiC (Silicon Carbide).**

INTRODUCTION

A composite material is a material consisting of two or more physically and/or chemically distinct phases. The composite generally has superior characteristics than those of each of the individual components. Usually the reinforcing component is distributed in the continuous or matrix component. When the matrix is a metal, the composite is termed a metal-matrix composite (MMC). In MMCs, the reinforcement usually takes the form of particles, whiskers, short fibers, or continuous fibers.

LITERATURE SURVEY

T.R. Vijayaram, S. Sulaiman,(2005) define Squeeze forming process is a special casting technique that combines the advantages of traditional high pressure die casting, gravity permanent mold die casting and common forging technology. It is a relatively new casting process. It is otherwise called squeeze forming, liquid forging, liquid pressing, extrusion casting, liquid metal stamping, pressure crystallization and corthias casting. The above said process was first discovered by the Russians and later it was developed in countries like

USA, Europe and Japan. This advanced casting method is applied for processing of both ferrous and non-ferrous materials besides composites. The major advantages of this technology are elimination of porosity and shrinkage, 100% casting yield, attainment of greater part details, good surface finish, good dimensional accuracy, high strength to weight ratio, improved wear resistance, higher corrosion resistance, higher hardness, resistance to high temperature, improved fatigue and better creep strength.

D. Saraev, (2001), Analyzes 3D Finite element calculations comparing to axisymmetric calculations have been performed to predict quantitatively the tensile behaviour of composites reinforced with ceramic particles aligned in stripes. The analyses are based on a unit cell model, which assumes the periodic arrangement of reinforcements. The results are presented in such a manner that can be directly compared for all possible aspect ratios and inclusion volume fractions. It is indicated that varying the distance between the stripes when particle volume fraction is kept constant significantly influences the overall mechanical behaviour of composites. Whereas during elastic deformation 3D and axisymmetric formulations predict quantitatively similar results, the mechanical behavior perpendicular to the stripe direction predicted by 3D and axisymmetric models may differ depending on the inclusion volume fraction.

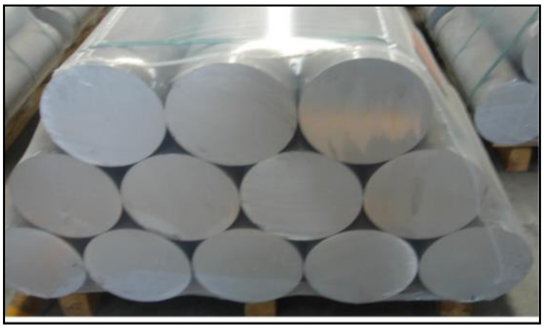
J.W. Kaczmar, K. Pietrzak(2000), Studied the production methods and properties of metal matrix composite materials reinforced with dispersion particles, platelets, non- continuous (short) and continuous (long) fibers are discussed in this paper. The most widely applied methods for the production of composite materials and composite parts are based on casting techniques such as the squeeze casting of porous ceramic preforms with liquid metal alloys and powder metallurgy methods. On account of the excellent physical, mechanical and development properties of composite materials, they are applied widely in aircraft technology and electronic engineering, and recently in passenger-car technology also.

RAW MATERIAL

Table 1 shows the details of raw material used for the composite. Figure 1 shows the Al 6061 and the SiC in the powder form.

Table 1 Statistics of Material

SR NO	MATERIAL	PHASE	COST (rupees)/ Kg
1	Al (6061)	Solid	350
2	SiC	Powder	1300



(a) **(b)**

Figure 1 Aluminum 6061 and Sic in powder form

EXPERIMENTAL WORK

Step 1: Preparation of casting

As shown in the figure 2 the experimental set up is developed. Al in the solid form is put in the crucible and then Al is melted and stirring effect has started as shown in figure 3. SiC in the powder form is added in the crucible and during all the casting stirring time has kept constant of 10 min.

Step 2: Preparation of Specimen of various compositions

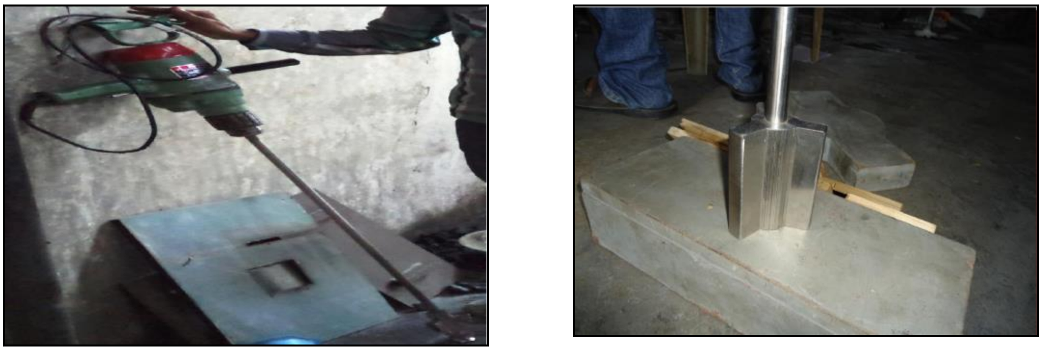
The alloying element SiC is mixed proportionately by weight in the ratio of 5%, 10% and 15%. The percentage of alloying element to be used is determined by literature review and history for development of this work

Step 3: Machining of specimen for test.

The castings are machined according to the ASME-IX. All the machining is done on the conventional lathe machine as shown in figure 4.

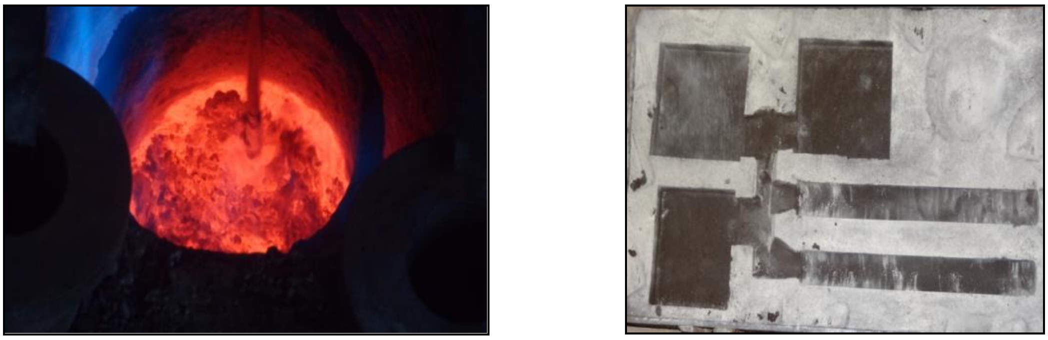
Step 4: Checking of UTS and YTS.

The testing of specimen is done at METHEAT ENGINEERING PVT LTD, VADODARA.



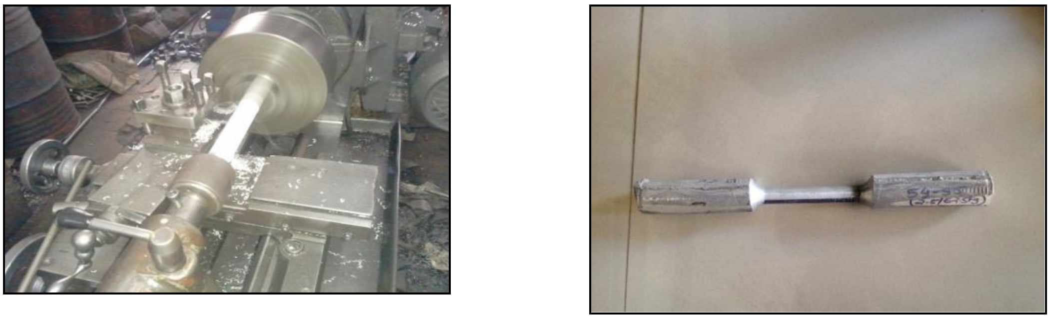
(a) (b)

Figure 2 Assembly of motor and stirrer and bladed stirrer



(a) (b)

Figure 3 Stirring effect & gating system for casting



(a) (b)

Figure 4 Machining of tensile test specimen and tensile test specimen before testing

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RESULTS

Table 2 shows the results of % elongation and the BHN along with the weight percentage of the SiC for all the specimens prepared from the casting.

Table 2 results of % elongation & BHN of all the specimens

EX NO	Wt% of SiC	% ELONGATION	AVG % ELONGATION	BHN	AVG BHN
1	5	5.2	4.8	54-55	54.83
2	5	4.9		54-55	
3	5	5.6		54-55	
4	5	3.4		57-58	
5	5	4.6		54-55	
6	5	5.2		56-57	
7	10	4.2	4.6	54-55	56.83
8	10	5.2		57-58	
9	10	4.2		58-59	
10	10	4.2		58-59	
11	10	4.9		57-58	
12	10	5		57-58	
13	15	4.2	4.0	57-58	57.33
14	15	4.6		57-58	
15	15	3.2		57-58	
16	15	3.6		57-58	
17	15	4.1		58-59	
18	15	4		58-59	

From the table 2 it is clear that as the weight percentage of SiC increases the material becomes more brittle so due to which the elongation of the material decreases. And the hardness of the material increases as the weight percentage of the SiC the reason behind that is that the material becomes harder mainly due to the carbide. Furthermore study can be carried out to check out the thermal properties of the composite.

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