



## **INVESTIGATE THE PROPERTIES OF AA6061 REINFORCED WITH ANIMAL BONE POWDER BY USING STIR CASTING TECHNIQUE**

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### **Abstract:**

Aluminium alloy based metal matrix composites (AMMC) are widely used for improving the tensile and hardness properties. AMMC are fabricated using various methods like liquid state fabrication, solid state fabrication methods, etc. It was found that stir casting is an economical method to fabricate AMMC. In the present work, aluminium alloy 6061 reinforced with various percentages of animal bone powder particles (5, 10wt %) were prepared. At first the stir casting set up was prepared as per the requirement. The objectives of this research work are the fabrication and characterization of AA6061 (Aluminium Alloy 6061)/ animal bone powder AMMC which was fabricated using stir casting process. The microstructures of AMMC were studied using Scanning Electron Microscope (SEM). Animal bone powder particles were observed to refine the grains and were distributed homogeneously in the aluminium matrix. Animal bone powder particles clusters were also seen in a few places. Animal bone powder particles were properly bonded to the aluminium matrix. The reinforcement of animal bone powder particles improved the hardness and tensile strength.

**Key Words:** AMMC, Animal Bone Powder, Stir Casting SEM & Hardness and Tensile

### **1. Introduction:**

The composite materials having a good combination of tensile strength and hardness. Aluminium based alloy plays important role in production of MMC. AMMC have used in more applications. AMMC can be fabricated in many ways based on the application. There are more types of aluminium is available in market. But among these AA6061 is quite popular choice as matrix material. It is primarily due to its better characteristics and option of modifying (or) increasing the strength of composite by heat treatment process AA6061 – Animal bone powder composite is not readily available in market. This is due to the difficulty in producing the composite.

Stir casting process is the economical way of producing composites. It is conventional one. Before doing the stir casting process we need to check the reinforced materials for its wettability. If it is not suitable means we can go to powder metallurgy route. Stir casting process helps to minimize the production related problems. In preparing AMMC by stir casting method, there are several factors that need to considerable attention, including (a) the difficulty of achieving a uniform distribution of the reinforcement material, (b) porosity in the cast metal matrix composites.

### **2. Research Methodology:**

#### **Materials:**

<b>Specimen</b>	<b>Aluminium 6061</b>	<b>Animal Bone Powder</b>
Sample 1	750gms	10%(75gms)
Sample 2	750gms	5%(38gms)

Table 1

#### **Stir Casting Process:**

It is a liquid metallurgy technique. 750 grams of aluminium were melted in a graphite crucible. For the melting of aluminium it will take 900kelvin. The animal bone powder was also preheated about 900k to remove the moisture content. In our research we were taken a reinforced particle about (5%, 10%) Table 1. Once the aluminium was melted which is mixed with animal bone powder by using stirrer. The stirrer is made up of mild steel shown in figure 1.

In preparing metal matrix composites by the stir casting method, there are several factors that need considerable attention, including (a) The difficulty of achieving a uniform distribution of the reinforcement material ; (b) Wettability between the two main substances ;(c)Porosity in the cast metal matrix composites; and (d) Chemical reactions between the reinforcement material and the matrix alloy.



Figure 1: Stir Casting Set Up

**3. Literature Survey:**

The aluminum based composites was investigated by Ramadurai [1] using stir casting technique. They had used different reinforced materials for different applications. Microstructure and mechanical properties of aluminium metal matrix composite was investigated by Praveen Kumar [2] with the addition of bamboo leaf ash by stir casting method. In that the density of the composite was increased by 4%. The mechanical and microstructure properties of alumina-6061 aluminium alloy joined by friction welding were investigated by m.n.ahmad fauzi [3] in this process the quality of the welding was improved. The characterization of functionally graded al-sic metal matrix composites manufactured by centrifugal casting was investigated by m.h.ahmed [4] from that they told that when we are using functionally graded material tensile, hardness and wear rate measurements will be increased.

**4. Result and Discussion Microstructures:**

The samples of different wt (%) of animal bone powder with AA6061 were prepared by using stir casting process. Then the samples were prepared by grinding through different grit paper for removing saw marks and then it was polished about 1 hr then the samples were undergone for scanning electron microscope test. SEM (CARE institute of technology, Trichirapalli).the microstructure of MMC casting at different percentage of animal bone powder is shown in fig. 2 & 3. This micrograph shows that the animal bone powder was distributed uniformly at 5% sample. In 10% sample porosity was formed.

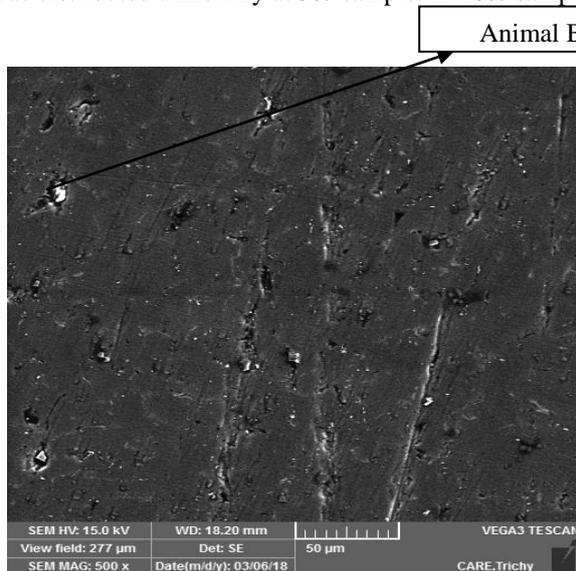


Figure 2: SEM image for 5% of alloying element (animal bone powder).the animal bone powder got mixed with AA 6061 during stir casting.

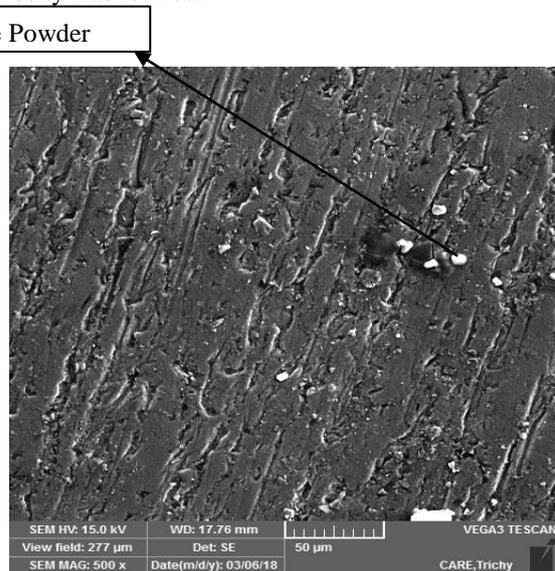


Figure 3: SEM image for 10% of alloying element (animal bone powder).the animal bone powder got mixed with AA6061 during stir casting.

	Tensile Strength (Mpa)
Sample 5%	199.25
Sample 10%	142.62

Table 2: Tensile Test

Tensile test were taken for absorbing the mechanical properties of the composites (table 2). The specimen with a width of 6.38mm, thickness 9.74mm, gauge length 25mm were taken and undergone for tensile test. As the reinforcement percentage increases, the ultimate tensile strength was decreases (FIG 4). At 10% reinforcement percentage the tensile strength was decreased due to the high porosity.

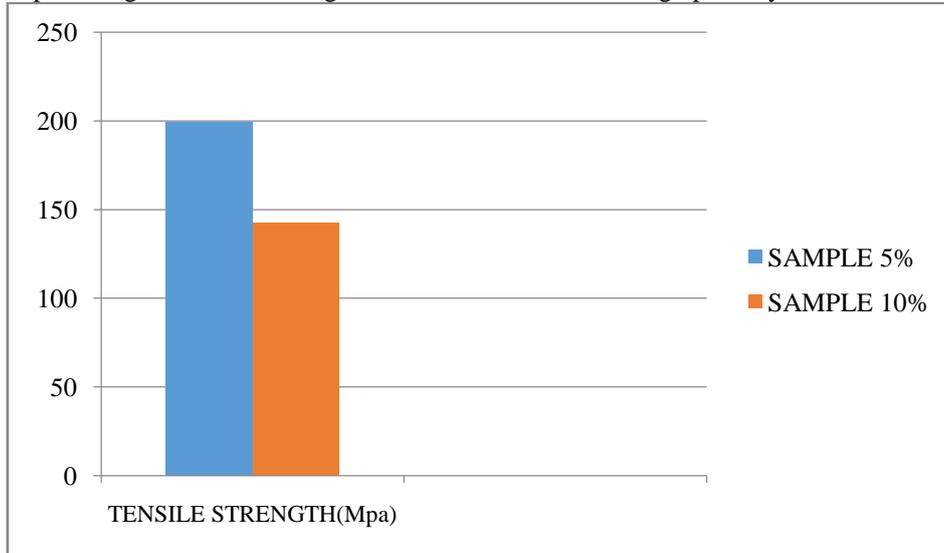


Figure 4: Tensile Test

Sample	Hardness in HBW		
	Sample 5%	65	63
Sample 10%	68	66	65

Table 3: Hardness test

The hardness test is, by far the most valuable and most widely used mechanical test for evaluating the properties of metals as well as certain other materials. the hardness of the material usually is considered resistance to permanent indentation. In general, an indenter is pressed into the surface of the metal to be tested under a specific load for a definite time interval and a measurement is made up of the size (or) depth of the indentation (TABLE 3). The principle purpose of the hardness test is to determine the suitability of the material for a given application (or) the particular treatment to which the material has been subjected the ease with which the hardness test can be made has made it the most common method of inspection for metals and alloys. The hardness strength of sample 10% is more when compared to 5% sample shown in fig 5.

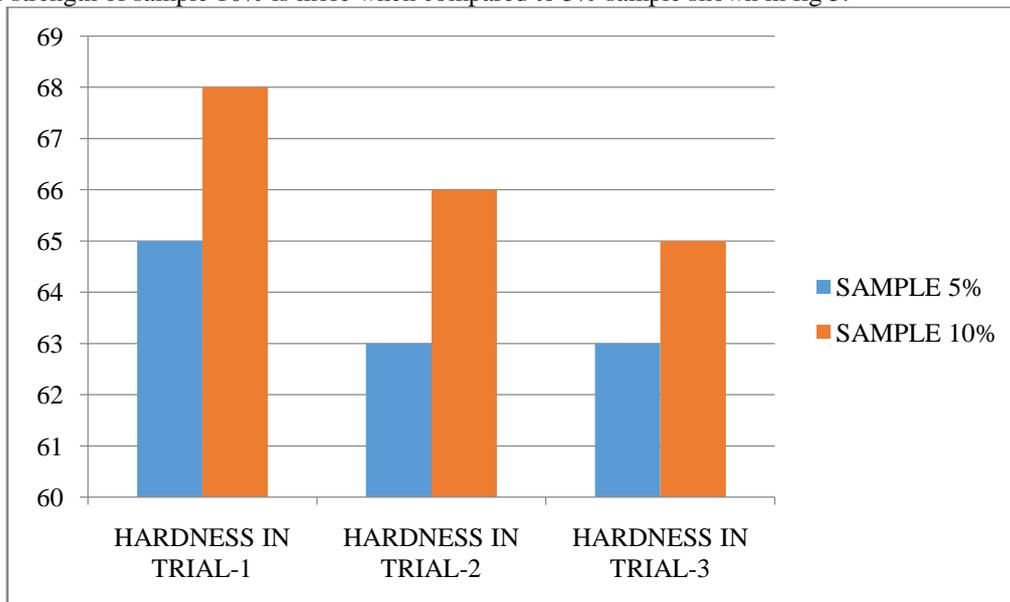


Figure 5: Hardness Test in HBW

### 5. Conclusion:

In the present work AA6061/animal bone powder AMMC were successfully fabricated using stir casting process. The effect of animal bone powder content on microstructure and mechanical properties were discussed. AA6061/animal bone powder reveal reasonable increase in hardness and tensile with increasing

animal bone powder content. It observed that 5% sample having more tensile strength and 10% sample having more hardness. Through SEM microstructure image we observed that porosity was increased with increasing percentage of animal bone powder in composites. The perhaps could be due to inefficiency of stirring during casting of the composite.

**6. Acknowledgement:**

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**7. References:**

1. Ramadurai K, Chanakyan C, Janet A & Bharathikanna “Effect of TIB<sub>2p</sub> particulate addition in aluminium 6061 through stir casting technique”, International Journal of Multidisciplinary Research and Modern Education (IJMRME), Volume II, Issue I, 2016.
2. B. Praveen Kumar, Anil Kumar BIRRU, “Microstructure and mechanical properties of aluminium metal matrix composites with addition of bamboo leaf ash by using stir casting method”, Elsevier, Volume 27, Issue 12, December 2017.
3. M. N. Ahmad Fauzi, M. B. Uday, H. Zuhailawati, A. B. Ismail, “microstructure and mechanical properties of alumina-6061 aluminium alloy joined by friction welding”, Elsevier, volume 31, issue 2 Feb. 2010.
4. I. M. El-galy, M. H. Ahmed, B. I. Bassiouny “Characterization of functionally graded AL-SiC metal matrix composites manufactured by centrifugal casting”, Elsevier, revised 24 Jan 2017.