FABRICATION AND CHARACTERIZATION OF Al 7075 MMCREINFORCED WITH GRAPHITE

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Abstract
The Al alloys are been widely used in the field of automobiles, aerospace, packing and electronic technology because of its high specific strength, high processibility anti erosion and eco-friendly nature.

Among the Aluminium alloy Al 7075 being a wide used alloy because of its high strength and its resistance to stress and strain makes it highly useful in aerospace appliances hence Al 7075 has been used as a matrix material and to increase the surface hardness of the alloy a primary significance graphite has been used. To understand the enhanced properties of the alloys mechanical tests like compression, Hardness, We are been carried out.

To confirm the uniform distribution of graphite in the matrix material characterization is done through microstructures.

Key words: Aluminium Alloy

1. Introduction

Composite materials are those made from two or more constituent's material when fused together produces a material with distinguished properties difference from properties of individual material often resulting in superior product.
A composite material can be defined as a combination of two or more chemically distinct metals and ceramics which are embedded with particles or fibers to improve their properties. The constituents retain their identities in the composite; they do not dissolve or otherwise merge completely into each other, although they act in concert. Composites are one of the widely used materials because of their adaptability to different situations and the relative ease of combination with other materials to serve specific purpose and exhibit desirable properties. Aluminium 7075 alloy constitutes are widely employed in aircraft and aerospace industry. The most important benefit of Aluminium 7075 is its high strength. Its resistance to stress and strain makes it highly useful in aerospace applications where it allows for weight savings over steel.

2. Advantages of composite materials

- The longitudinal strength of composite is 4 to times higher than conventional metal.
- The composite material has more stiffness and improves mechanical strength.
- The composites are used for vibration absorbing material because it has less noisy materials and provide low vibration transmission than metals.
- It is used for dynamic characteristics like fatigue, and also used for impact, environmental resistance and low maintenance cost.
- The cost of composite material is low when compared to metals.
- It reveals good corrosion resistance property.

3. Literature Survey

Jianwen zhao et al. [3], carried out experiment ‘‘A synthesis Fatigue of 7075- 7651 aluminium alloy’’ The Fatigue experiment were conducted using aluminium alloy under uniaxial, torsion and axial-torsion, the fatigue process consists pf crack initiation and crack propagation to failure. The Fatigue

experiment were conducted using aluminium alloy under uniaxial, torsionand axial-torsion.
The main stress has a significant effect on fatigue, SWT criterion combines the normal in shear components of the stress.
K. Periswamy et al [5], carried out experiment ‘‘mechanical properties of 7075- t6 aluminium alloy surface hybrid composites synthesized by friction stir processing’’ And concluded with various composition of reinforced particles such as silicon carbide and graphite. Experimental results indicate that the strength and micro hardness are compared with samples.
Arun Prakash S et al. [7] The experimental works shows about the fabrication of composites and its characterization of Aluminium metal matrix composites (AMCs). AA7075 T6 base metal base with Tungsten carbide (WC) particulate with various reinforcements 2.5%, 5.0%.7.5%, 10%, 12.5% was produced by stir casting technique.
G. Sutradhard et al. [8] This experiment indicates the influence of machining parameters such as cutting forces and surface roughness on the machinability of LM6/ SiCp metal matrix composites at different weight fraction of SiCp. Machining tests were carried out at different cutting speed (i.e.30, 68 &103 m/min) and different depth of cuts (i.e.0.5, 1.0 & 1.5mm) at constant feed rate.
It is also observed that higher weight percentage of SiCp reinforcement imparts a higher surface roughness and needs high cutting forces. Strength to decrease or stop the speed in wheel rotation.

S.K. Rajendra et al [1], carried out experiment ‘‘A synthesis of BERLY. Reinforced aluminium metal matrix composites through vacuum sintering’’ Investigation reveals significant improvement in hardness and sliding wear properties.

3. Objective

1. To prepare the Aluminium 7075 Composite materials reinforced with graphite using stir casting technique.
2. To machine the stir casted composite materials according to the ASTM standard.
3. To characterize the prepared composite materials by Microstructure.
4. To understand the Mechanical and Tribological properties like Compression, Hardness and Wear test of the prepared composites.

4. Material Selection

Aluminium alloys (Al) is the predominant metal. The typical alloying elements are copper, magnesium, manganese, silicon, tin and zinc. There are two principal classifications, namely casting alloys and wrought alloys, both.

Alloys composed mostly of aluminium have been very important in aerospace manufacturing since the introduction of metal-skinned aircraft. Aluminium-magnesium alloys are both lighter than other aluminium alloys and much less flammable than alloys that contain a very high percentage of magnesium.

5. Mechanical properties of aluminium alloy

Properties	**Metric**
Tensile strength	220 MPa
Yield strength	95 MPa
Shear strength	150 MPa
Fatigue strength	160 Mpa
Elastic strength	70-80 GPa
Poisson’s ratio	0.33
Elongation at break	17%
Hardness	60

6. Aluminium Casting Procedures

Stir Casting → Machining → Testing → Vickers Hardness test → Compression Test → Microstructure → Results

7. Wear Test Results

This table illustrate the wear test results for the fallowing compositions. Speed 300 RPM, WTD 100mm, Duration 10min

Serialno	composition	load	Frictional forceN	Average
1	0%	20N	120.52	7.69
		30N	101.91	13.13
2	1%	20N	112.27	8.22
		30N	129.48	13.30
3	2%	20N	89.37	7.72
		30N	136.13	12.65
4	3%	20N	86.24	7.95
		30N	241.15	11.45

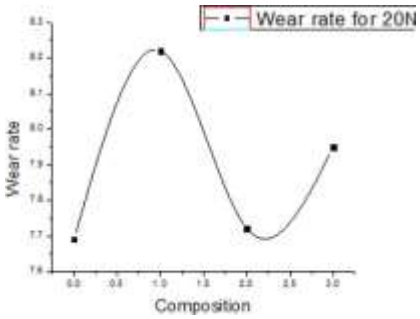


Fig 6.1.1 WEAR TEST GRAPH FOR 20 N

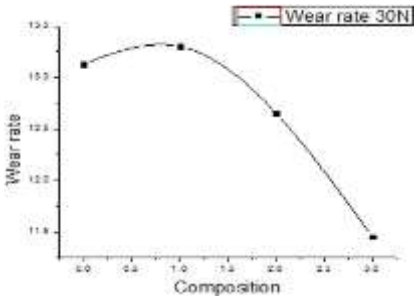


Fig 6.1.1 WEAR TEST GRAPH FOR 30 N

8. Compression Test Results

This table illustrate the Compression test results for the fallowing compositions.

SL.NO	COMPOSITION	BREAKINGLOAD
1	0%	176.2 KN
2	1%	120.18 KN
3	2%	157.98 KN
4	3%	173.85 KN

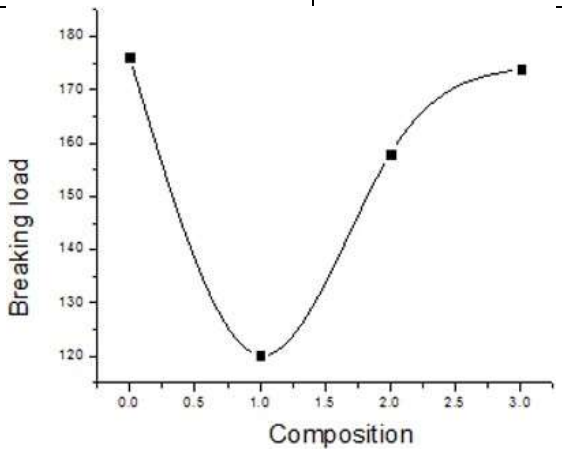


Fig 6.2.1 COMPRESSION TEST GRAPH

9. HARDNESS TEST RESULTS

Table illustrate the Hardness test results for the fallowing compositions.

SL NO	COMPOSITION	VHN	AVERAGE
1	0%	82.1	82.6
		83.1	
2	1%	95.4	90.3
		85.2	
3	2%	68.5	68.95
		69.4	
4	3%	83.9	81.3
		78.7	

TABLE 6.3 HARDNESS TEST

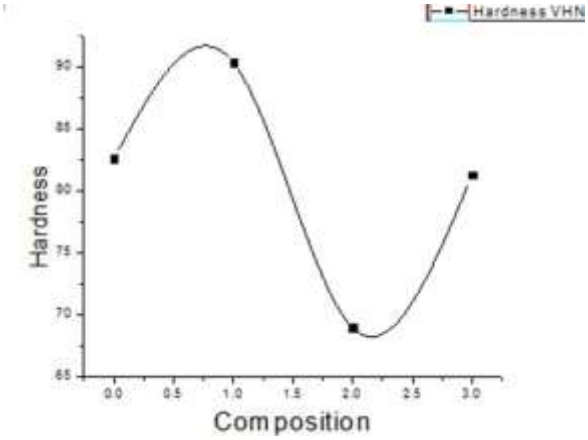


FIG 6.3 HARDNESS TEST GRAPH

10. Microstructure Test Results

The below figure is the magnified image of Al 7075 composite reinforced with graphite obtained from the microscopy.

0% Composition

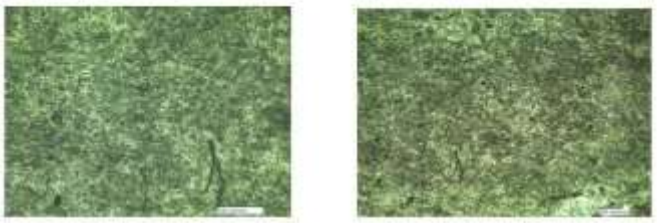
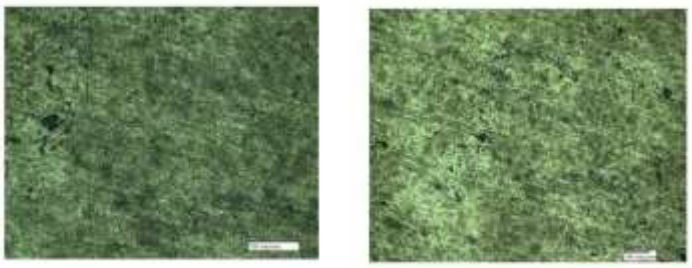


Fig 6.31 illustration of microstructure test result

1% Composition



- 2% Composition

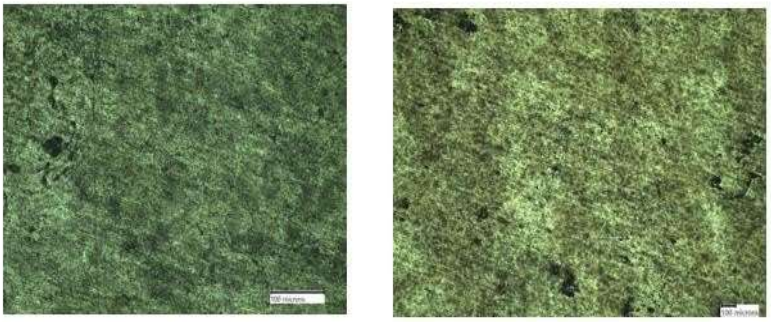
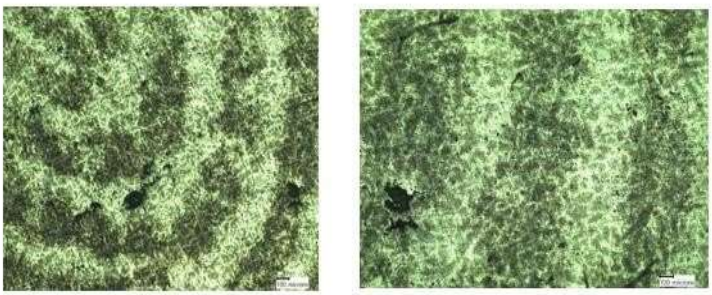


Fig 6.33 illustration of microstructure test result

- 3%



11. Conclusion

1. WEAR TEST

   with the increasing percent of graphite, it has been observed that the wear rate decreased. this is because of the graphite getting exposed on the surface when the specimen being used for longer time.

2. COMPRESSION TEST

   from the graph pure Al shows higher compressive strengths compare to the reinforced composition. It has been also observed with the increasing percentage of graphite the compressive strength gotincreased.

3. MICROSTRUCTURE TEST

   From the microstructure images it is clear that there is no surface defects and cracks. In some portion of the images the graphite particles are to be seen ensuring the presence of graphite in the specimens.

12. Reference

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