

EXAMINATION OF MECHANICAL AND TRIBOLOGICAL PROPERTIES OF ALUMINIUM 7075 REINFORCED WITH TUNGSTEN CARBIDE AND FLYASH

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Abstract - The Aluminium based Metal Matrix Composites (MMCs) are generating wide interest in space, vehicle, transportation and submerged applications. This is primarily due to its superior and tolerable properties like as light weight, low density, high hardness, high temperature resistance and corrosion resistance. Metal matrix composites are molded by Mix of two or more materials (at least one of the materials is metallic) having unlike features. In this current study aluminium 7075 (Al 7075) as base matrix metal, tungsten carbide (WC) particulate and fly ash as reinforcements. Aluminium MMCs are prepared by stir-casting process. The Tungsten Carbide particulate was added in quantities of 1.5%, 3% and 4.5% and Fly ash was added in quantity of 2% on weight fraction basis to the liquefied metal. The different grouping sets of composites were organized to study Mechanical properties like microstructure, hardness, tensile & Compressive strength and tribological properties like wear loss of as cast Al7075 as well as reinforced Al7075 models before heat treatment and same properties studied after heat treatment. Microstructure observation was done by using optical microscope to get the dissemination of tungsten carbide particulate and fly ash in base matrix metal. Hardness and Strength is checked in Brinell hardness tester and UTM machine. Amount of wear loss is found by weight loss method using pin on disc apparatus on from the outcomes, it was found that microscopic images of the samples indicated uniform distribution of tungsten carbide and fly ash particles in the base matrix without voids before and with voids after testing. Tensile strength, Hardness and Wear resistance of the prepared metal matrix composites increased through increase of 3% weight of tungsten carbide and 2% weight of Fly ash in casted and heat treated samples.

Key Words: Aluminium 7075, Tungsten Carbide, Fly ash

1. INTRODUCTION

In now daily's composite material are utilized in various number of utilization as they are reasonable and composite material are increasing across the board acknowledgment, due to its attributes properties and it have high quality and low weight. Of these composites aluminium metal lattice composites (AMMCs) are utilized in number of uses since it is appropriate for specific structure and it likewise have enhanced in mechanical properties (like enhanced in young's modulus, high return quality, high hardness, and huge elasticity. These is a direct result of the small scale estimated molecule as fortification present in the metallic network), physical properties and tribological properties and furthermore the warm conductivity of composite material are great. Composite materials are utilized in the field of automotive, air art and guard application.

2. MATERIALS AND METHODOLOGY

- Selection of the essential and auxiliary stage materials.
- Matrix: Aluminium 7075 alloy
- Reinforcement: Fly fiery debris and Tungsten carbide
- Method used to deliver particulate strengthened aluminium half and half metal framework composites.
- Liquid metallurgy process: Stirr throwing is utilized to deliver the examples with various weight portion of support Tungsten carbide and steady Fly cinder.
- Microstructure ponder is completed utilizing Optical magnifying lens to guarantee even appropriation of fortification in the created examples.
- The created examples are machined by ASTM standard for Hardness test, elastic test and Wear test.
- Mechanical and Tribological tests are directed to know the properties of composites with various weight parts of support (both Untreated and Treated) and v results are thought about

2. RESULTS AND DISCUSSION

2.1 TENSILE TEST

Ductile test are performed on UTM (Universal Testing Machine) as examined in area 4.5 the readied examples is then exposed to pliable test. Tractable test are performed by ASTM E8-16a

Table: 1 The UTS (Ultimate Tensile Strength) estimations of Al7075 as shaped and its composites

Sl No.	Alloy/Composites	UTS (MPa)
1	A1 (Al7075 as cast)	179.116
2	A2	190.462
3	A3	213.187
4	A4	189.792

From above table UTS estimation of A1 i.e. as cast is 179.116MPa. In Al7075 combination, on the off chance that we include 1.5% WC and 2% Fly cinder (A2) UTS esteem is expanded i.e. 190.462MPa, by contrasting A2 and A1 there will be addition in 6.42% of UTS esteem A2.

UTS, Mpa

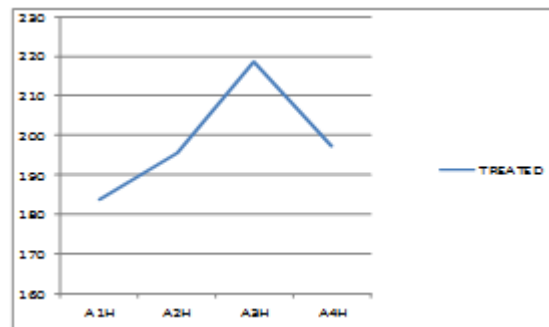


Figure: 1 UTS values of as cast Al7075 alloy and its composites with Heat Treated

Table: 2 Comparison of UTS value of Untreated and Heat treated alloy and it's composite

Sl No	Alloy Designation	Untreated UTS (MPa)	Alloy Designation	Heat treated UTS (MPa)
1	A1	179.116	A1H	183.726
2	A2	190.462	A2H	195.462
3	A3	213.187	A3H	218.693
4	A4	189.792	A4H	197.448

From the table it is seen that the most extreme UTS is 213.187 MPa (Ultimate Tensile Strength) for A3 (Al7075+ 3%WC+2%Fly fiery debris, with untreated) and the least estimation of UTS is 114.448 MPa which is for A4H (Al7075+ 3%WC+2%Fly Ash, with warmth treated).

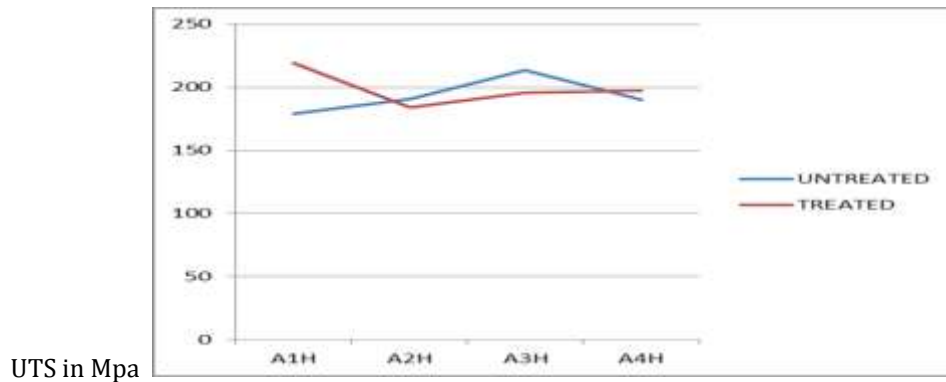


Figure: 2 Graph of UTS values of Untreated and Heat Treated alloy and its composites

3.2 COMPRESSIVE TEST

Compressive test for untreated Al7075 Alloy and its composites: The experiments were carried out in the universal testing machine.

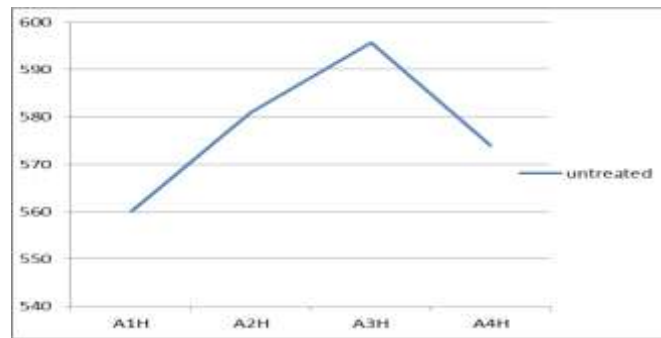


Figure: 3 Alloy designation VS strength.

Table : 3 Comparison of compressive test of heat treated and untreated Al7075.

Alloy/ composites	Strength coefficient, K [MPa] UNTREATED	Strength coefficient, K [MPa] TREATED
Al7075 A1H	560.03	579
Al7075+2% Fly ash+ 1.5% WC A2H	580.9	591
Al7075+2% Fly ash+ 3% WC A3H	595.7	613.90
Al7075+2% Fly ash+ 4.5% WC A4H	573.99	603.11

Alloy/ composites	Strength coefficient, K [MPa]
Al7075 A1	560.03
Al7075+2% Fly ash+ 1.5% WC A2	580.9
Al7075+2% Fly ash+ 3% WC A3	595.7
Al7075+2% Fly ash+ 4.5% WC A4	573.99

As cast AL7075 and its composites results are plotted in below table. From the above table result it can be seen that the compressive strength for heat treated is higher as compared to compressive strength for untreated specimens

Strength of Coefficient

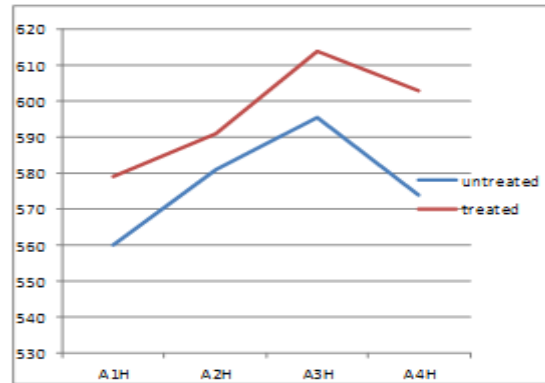


Figure: 4 Graph of Alloy designation VS strength

4. CONCLUSIONS

The Al7075/Fly fiery debris/WC composite is effectively created with various weight parts of differing Tungsten carbide and keeping steady fly ash (2%) utilizing traditional mix throwing technique. Following end are made

- The Microstructure contemplate affirmed the uniform dispersion of fortification particles in the framework.
- The yield pressure and rigidity of the MMC increments when the 3 % of tungsten carbide with 2% fly fiery debris. Hardness of the material expanded with increment of tungsten carbide 4.5% with 2% of fly fiery debris.
- Heat process results in the modification of needle shaped little bits of tungsten to circular frame, diminishing in size and equivalent conveyance in the network. The composite with 2% Fly fiery debris and 3% Tungsten carbide has most noteworthy UTS, flexibility and wear opposition decreased.

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