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PREPARATION AND EVALUATION OF EFFECT OF GRANITE PARTICLES AND ALUMINIUM OXIDE REINFORCEMENT ON STRENGTH PROPERTIES OF AL7075 METAL MATRIX COMPOSITE

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ABSTRACT

There is an increasing demand for new materials with the modernization, for which composite will be a compromising solution. Research on composite are not new but their experiments are never ending due to vast number of material availability and their combinations, which keep the research ahead with the greed of new improved materials. This work concerns the use of aluminum oxide and waste materials like granite particles produced during granite slab preparation, as reinforcements with Al7075 alloy and to study its effect on mechanical strength on produced metal matrix composites. Upon investigation, combination of granite powder (3 wt%, 6 wt% & 9 wt%) and a constant percentage of Al2O3 (3%) with Al7075 shows significant improvement in hardness and tensile strength as compared to base metal alone.

Keywords: *Metal matrix composite, Granite powder, Aluminium oxide, Al7075*

INTRODUCTION

Composite material, as the name itself indicates, it composed of different materials to get a superior properties than their parent metal alone. Composites are formed by bonding two different phase material which are distinct in nature, that is where it stands differ from alloy. The property of a composite is influenced by various parameters like reinforcement distribution, size, bonding between materials, morphology, density etc., Commonly used base metals in metal matrix composite are Al, Mg, Ti, Cu and their alloys and the reinforcements may be in the form of particulates, short fibers, whiskers. Among these, particulate reinforced metal matrix is of prime concern due to their cost effectiveness and easy formability.

Anand pai et al (2015) have conducted a study on the influence of graphite and granite dust particles as reinforcement on Al6061alloy, based on the tensile and wear study have concluded betterment of properties with the addition of reinforcement than the base metal. Bhargavi rebba et al (2014) have studied the effect of molybdenum disulphide addition to Al2024 alloy and stated an increase in mechanical property up to 4% reinforcement and a drop for 5%. Bharath v et al (2014) used 3 step stirring to add reinforcement to aid better distribution and wetting and stated an increase of tensile strength and hardness with the increasing additional level of reinforcement. Hasim et al (2001) prepared A359 and silicon carbide composite using stircasting and enhanced wettability between SiC particles and alluminium alloy by the addition of magnesium. Wettability can be improved to certain extent by preheating the reinforcement particles to remove absorbed gases fromparticle, S.A. Sajjadi et al (2011)

MATERIALS AND METHODS

For the present work the granite dust is procured from the local granite industry and the Al_2o_3 Al7075 is commercially available. The composition of granite powder is shown in Table1. The obtained granite powder was sieved and particles ≤100µm were collected and directly used for casting in initial stage, upon preheating the grey dust is turned to brownish in colour and it formed from black burnt like patches on casted specimens. And even the results was not fruitful. Later the granite powder was thoroughly washed and dried before sieving, even after the treatment the colour change was common where as the black patches was not formed.

For preparation of composite stir casting route is employed, small pieces of Al7075 was charged into the crucible and left to melt at 750^0c. After complete melting, solid hexachloroethene tablets are used for degassing. Cover all (an alkaline halide salt) is used to reduce oxidation and magnesium to improve wettability. The

reinforcements are preheated to 400^0c prior to addition to remove any moisture content present and also to improve wettability. Permanent hot die steel moulds are also preheated for 500^0c. vortex is generated by stirring at a speed of 400RPM and the stirrer positioned at a depth of ½ height of the molten metal. The experimental set up is as shown in Fig 1.

Table 1. Chemical composition of granite particles

constituent	Sio_2	Al_2o_3	Fe_2o_3	CaO	others
Wt%	63.8	19.2	8.6	4.3	4.1

The tensile specimen are prepared according to ASTM E8 standard from the casted rods. And specimens of dimension 20mm length and 20mm diameter is used to obtain BHN. The different composition % details are given in Table 2.

Fig 1. Experimental setup

Table 2. composition selected and designation

designation	*Composition*
Al	*Al7075*
3GR	*Al7075+3%*Al_2o_3+3% Granite particles
6GR	*Al7075+3%*Al_2o_3+6% Granite particles
9GR	*Al7075+3%*Al_2o_3+9% Granite particles

RESULTS AND DISCUSSION

The tensile test and hardness test results are shown in table 3 below and the SEM images showing the microstructure and distribution is presented in Fig 2, Fig 3 and Fig 4 for respective % of reinforcements.

Table 3. mechanical properties of prepared composite

Mechanical property	Al	*3GR*	*6GR*	*9GR*
Tensile strength	342	364	368	276
Hardness	117	126	129	137

The tensile strength increases with reinforcement as compared to base metal whereas 9GR suffers in strength may be due to higher percentage of reinforcement leading to brittleness and also due to agglomeration, but the hardness is increased as the ceramic granite particles contributes to enhance hardness.

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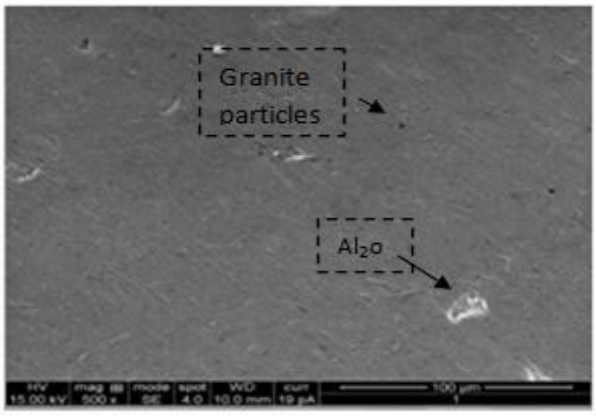

Fig 2. Microstructure of 3GR composition

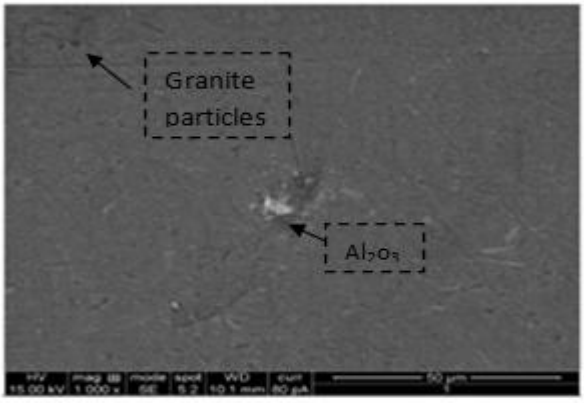

Fig 3. Microstructure of 6GR composition

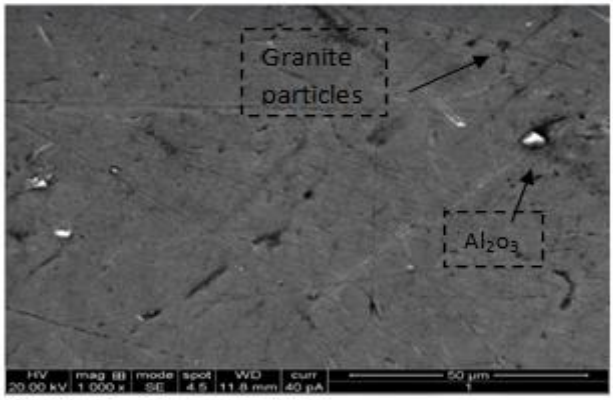

Fig 4. Microstructure of 9GR composition

CONCLUSION

In the current work 3 different composites are studied and tensile and hardness test are carried on prepared specimens, by which the following conclusions can be drawn,

- Hybrid composite incorporating granite particles and alumina can be successfully produced using stir casting technique
- The tensile strength is improved with the addition of reinforcements but suffers for 9% of granite powder.
- The hardness is improved due to the contribution of hard ceramic particles.
- By making use of waste materials like granite dust in preparing composite handling problems of granite dust can be solved up to some extint.

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REFERENCES

1. *Anand pai, Sathya Shankar Sharma, Raynor Errol D'Silva and R.R. Nikhil, "Effect of graphite and granite dust particulates as micro-fillers on tribological performance of al6061-T6 hybrid composites", in Elsevier tribology international, 2015,pp. 462-471.*
2. *Bhargavi Rebba, N. Ramanaiah, " Evaluation of mechanical properties of aluminium alloy (Al-2024) einforced with molybdenum disulphide (MOS_2) metal matrix composite", in Elsevier procedia, material science, 2014, 1161-1169.*
3. *Bharath V, Madev Nagaral, V Auradi and S.A. Kori, "Preparation of 6061 Al-* Al_2o_3 MMC's by stir casting and evaluation of mechanical and wear properties", on Elsevier procedia materials science, 2014, pp. 1658-1667.
4. *Hashim J., Looney L. and Hashmi M.S.J., "The enhancement of wettability of SiC particles in cast aluminium matrix composites" in journal of materials processing technology, 2001, pp. 329-335.*
5. *S.A. Sajjadi, Ezatpour H.R and Beygi H, "microstructure and mechanical properties of Al-* Al_2o_3 micro and nano composites fabricated by stir casting", in material science and engineering, 2011, pp. 8765-8771.