EXPERIMENTAL INVESTIGATION AND MECHANICAL PROPERTIES OF Al - SiC-FLY ASH COMPOSITE MATERIAL WITH SCOPE OF NANOSCIENCE

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ABSTRACT— Composites are most successful materials used for recent works in the industry. Metal composites possess significantly improved properties including high tensile strength, toughness, hardness, low density and good wear resistance compared to alloys or any other metal. There has been an increasing interest in composites containing low density and low cost reinforcements. Among various reinforced materials used, fly ash is one of the most inexpensive and low density reinforcement available in large quantities as waste product during combustion of coal in thermal power plants as well as in the brick factory and rice mill. Hence, composites with fly ash with Al along with SiC as reinforcement are likely to overcome the cost barrier as well as the different physical and mechanical properties for widely used in the automotive and space craft applications. In this casting was prepared and then undergone testing like hardness, impact and micro structural analysis.

Index Terms— SiC – Silicon Carbide, Al – Aluminium, Fly ash.

INTRODUCTION
Composite materials are important engineering materials due to their outstanding mechanical properties. Composites are materials in which the desirable properties of separate materials are combined by mechanically or metallurgically binding them together. Each of the components retains its structure and characteristic, but the composite generally possesses better properties. Composite materials offer superior properties to conventional alloys for various applications as they have high stiffness, strength and wear resistance. The development of these materials started with the production of continuous-fiber-reinforced composites. The high cost and difficulty of processing these composites restricted their application and led to the development of discontinuously reinforced composites (Ozdemir et. al.1999).

COMPOSITE TECHNOLOGY
Composite materials are materials made from two or more constituent materials with significantly different physical or chemical properties which remain separate and distinct on a macroscopic level within the finished structure. In an advanced society like ours we all depend on composite materials in some aspect of our lives. Fiber glass, developed in the late 1940s, was the first modern composite and is still the most common. It makes up about 65 per cent of all the composites produced today and is used for boat hulls, surfboards, sporting goods, swimming pool linings, building panels and car bodies. You may well be using something made of fiberglass without knowing it.

METAL MATRIX COMPOSITE
Metal matrix composite (MMC) is composite material with at least two constituent parts, one being a metal. The other material may be a different metal or another material, such as a ceramic or organic compound. MMCs are nearly always more expensive than the more conventional materials they are replacing. As a result, they are found where improved properties and performance can justify the added cost. Today these applications are found most often in aircraft components, space systems and high-end or “boutique” sports equipment. The scope of applications will certainly increase as
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LITERATURE REVIEW

K.v. Mahindra, et al (2007), Metal matrix composites (MMCs) are engineered materials, formed by the combination of two or more dissimilar materials (at least one of which is a metal) to obtain enhanced properties. In the present investigation, an Al–4.5% Cu alloy was used as the matrix and fly ash as the filler material. The composite was produced using conventional foundry techniques. The fly ash was added in 5%, 10%, and 15 wt. % to the molten metal. The Composite was tested for fluidity, hardness, and density, mechanical properties impact strength, dry sliding wear, slurry erosive wear, and corrosion. Microstructure examination was done using a scanning electron microscope. To obtain the distribution of fly ash in the aluminum matrix the results show an increase in hardness, tensile strength, compression strength, and impact strength with increasing the fly ash content. The density decreases with increasing fly ash content. Resistance to dry wear and slurry erosive wear increases with increasing fly ash content. Corrosion increases with increasing fly ash content.

Vivekananthan, M, et al (2009), Metal matrix composites (MMCs) constitute an important class of design and weight-efficient structural materials that are encouraging every sphere of engineering applications. There has been an increasing interest in composites containing low density and low cost reinforcements. Among various discontinuously dispersed solids used, fly ash is one of the most inexpensive and low density reinforcement available in large quantities as solid waste by-product during combustion of coal in thermal power plants. Hence, composites with fly ash as reinforcement are likely to overcome the cost barrier for wide spread applications in automotive and small engine applications. To produce Al matrix cast particle composites, wet ability of the ceramic particles by liquid Al is essential. To improve wet ability, elements such as Mg and Si are added into Al melt to incorporate the ceramic particles. The present investigation has been focused on the utilization abundant available industrial waste fly ash in useful manner by dispersing it into aluminum/aluminum-magnesium/aluminum-silicon matrix to produced composites by liquid metallurgy route. Wide size range (0.1-100μm) fly ash particles were used.

PRODUCTION

Because of the rarity of natural moissanite, most silicon carbide is synthetic. It is used as an abrasive, and more recently as a semiconductor and diamond simulant of gem quality. The simplest manufacturing process is to combine silica sand and carbon in an Acheson graphite electric resistance furnace at a high temperature, between 1600 and 2500 °C. Fine SiO2 particles in plant material (e.g. rice husks) can be converted to SiC by heating in the excess carbon from the organic material. The silica fume, which is a byproduct of producing silicon metal and ferrosilicon alloys, also can be converted to SiC by heating with graphite at 1500 °C.

Synthetic SiC Lely crystals
The material formed in the Acheson furnace varies in purity, according to its distance from the graphite resistor heat source. Colorless, pale yellow and green crystals have the highest purity and are found closest to the resistor. The color changes to blue and black at greater distance from the resistor and these darker crystals are less pure. Nitrogen and Aluminium are common impurities, and they affect the electrical conductivity of SiC.

APPLICATIONS
In the arts, silicon carbide is a popular abrasive in modern lapidary due to the durability and low cost of the material. In manufacturing, it is used for its hardness in abrasive machining processes such as grinding, honing, water-jet cutting and sandblasting. Particles of silicon carbide are laminated to paper to create sandpapers and the grip tape on skateboards.

NUMERICAL RESULTS OBTAINED FROM ANYSYS MIXING RATIO OF SiC 80% AL 10% FLY ASH 10%

CONCLUSION
From the obtained numerical results it was concluded that the followings. Addition of fly ash results a complete transformation in mechanical properties of Aluminium. Mechanical properties like hardness, impact strength and wear resistance are increased due to high hardness and on the contrary toughness, ductility, density and shrinkage are reduced. It is well known that molten Aluminium has affinity to hydrogen. Hydrogen is absorbed by Aluminium creating porosity. Therefore to avoid this porosity it is necessary that melt should be supplied with some degassing agents. Also concludes that out of four compositions, AL80SIC10FLYASH10 was providing better strength.
REFERENCES


