IMPACT: Journal of Modern Developments in Applied Engineering & Technology Research (IMPACT: JMDAETR)
Vol. 1, Issue 1, Jun 2017, 7-10

EFFECT OF REINFORCEMENT MATEIALS IN ALUMINIUM METAL MATRIX COMPOSITES ON MECHANICAL PROPERTIES

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ABSTRACT

Aluminum alloy is an important alloy for using in different types of engineering applications. It is used mostly because of light in weight, low density, and high stiffness, low cost and easy availability. Aluminium alloy with Metal Matrix Compositions (MMC) increased its usefulness according to its uses in industry. Aluminium Metal matrix composites are used mostly in aerospace industry and automotive industry**.** The study of this paper is to discuss the technology of composites and its performance behavior on different composition of reinforcement materials. The addition of composition in Aluminum alloy MMC and its changed proportion affects the mechanical behavior of the aluminum alloy MMC.

KEYWORDS: Aluminium, Metal Matrix Compositions (MMC), Fabrication, Industry

INTRODUCTION

Metal Matrix Composites (MMCs) are replacing conventional materials in many applications because of their superior properties such as high strength to weight ratio, hardness, stiffness and wear and corrosion resistances over conventional materials. These composites find various applications in the automobile industry, the aerospace industry and in defence and marine engineering. Various processes are used for making metal matrix composites like liquid fabrication methods, solid state fabrication methods, etc. various production processes like metal injection molding, friction stir process, mechanical alloying, squeeze casting technology, continuous binder-powder coating etc. Lot of work is going on in the field of production technologies of MMC which has brought down their cost to an acceptable level compared to those processed by powder metallurgy and spray casting process [01].

The effects of research in Aluminium based Metal Matrix Composites (MMC's) are far reaching these days. In metal matrix composites, extensive research work has been carried out on Al alloys. The matrix is the monolithic material into which the reinforcement is embedded, and is completely continuous. This means that there is a path through the matrix to any point in the material, unlike two materials sandwiched together [02].

REINFORCEMENT MATERIALCOMPOSITION

The aluminum-copper and aluminum-zinc alloys are the primary alloys used in airframe structural applications. Aluminum alloy specimens (6061) will be developed with variations of % of copper in the composition viz., 4%, 6%, 8%, 10% using die casting process. By changing the percentage of copper in aluminum is changing the mechanical behavior of material. In which tensile strength first increase up to 8% and after it decreases. It also affects the hardness no. and elongation, first increases and after it goes to decreases [03].

The hardness of the AL MMC composites increases as the fly ash content increases. The presence of SiO2 in fly ash increase wear resistance of Al MMC. It is observed that as the time increases the weight loss due to erosion increased for both Aluminum as well as ALMMC composites. However, the weight loss was minimum for the Al MMC composites [04].

In the composites hardness increased with increasing percentage of fly ash. The ultimate tensile strength of squeeze cast samples increases with increase in percentage of fly ash. Impact strength is higher for higher percentage of fly ash reinforcement [05].

The split tensile strength and young's modulus values decreased gradually as the silicon dioxide content in the composite increased from 5% to 30% by volume fraction. The reason for this mechanical behavior is due to the dominating nature of the compressive strength of the quartz particulate reinforced in the LM6 alloy matrix. The hardness value of the silicon dioxide reinforced LM6 alloy matrix composites is increased with the increased addition of quartz particulate in the matrix and it is well supported. Decreasing the silicon dioxide particulate content less than 30% along with the particle size constraint as 230 mesh-65 microns would increase the tensile strength but cracking on the surface might not be too dominant [06].

Metal matrix composites derive their excellent mechanical strength from combination of a hard reinforcement phase as MgO and a ductile matrix material, aluminum in which particle reinforcement aluminum formed using liquid metal handling particularly stir casting by varying the % MgO at different levels ranging from 0.05%, 0.10%, and 0.20% and the particle size 0.053, 0.106, and 0.22 and with increase in composition of MgO, an increase in tensile strength [07].

Introduction of silicon carbide reinforcements into the Al (LM6) matrix alloy reduces the liquidus temperature; This may be results as the presence of silicon carbide particles in matrix alloy reduces the superheat temperature range. Addition of ceramic reinforcement to alloy enhances the total solidification time, as the presence of insulating dispersoids i.e. SiCp plays a dominant role in reducing the cooling rates. Increase in fraction of SiCp, an increase in hardness has observed [08].

Aluminum metal matrix with Al4C3 reinforcement under powder metallurgical composites up to a critical temperature increases wear resistance, Hardness compression strength. Aluminium matrix reinforced with titanium carbide composites fabricated by Stir casting method in an argon atmosphere resulting enhanced specific strength and wear resistance [09].

Addition of agro-waste in Al MMC such as fly ash, palm oil clinkers, palm oil fuel ash, rice husk, coconut shell enhanced the existing material. Agro-waste can be utilized in automotive, industrial and construction as reinforce to produce better composites. An estimated value of particles content needed in order to increase the mechanical properties of existing material [10].

CONCLUSIONS

Aluminum based Metal Matrix Composites are extensively used in industry. Addition of different types of composition in Al MMC changes the mechanical behavior of the material. Addition of copper effects the tensile strength if the material. In addition of fly ash in Al MMC causes to increases the hardness, impact strength and wear resistance. Silicon dioxide content increase the hardness but its decreases the value of tensile strength. An increase the percentages of

MgO in Al MMC are increases the tensile strength. In addition of silicon carbide in Al MMC, increases the hardness of the material. Aluminum metal matrix with Al4C3 reinforcement increases the value of wear resistance and hardness. In addition of different contents of material in Al MMC mostly affects the hardness of the material.

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