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"A REVIEW ON ALFA COMPOSITE MATERIAL FOR AUTOMOTIVE CLUTCH PLATE APPLICATION"

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ABSTRACT:

Metal matrix composites reinforced with fly ash particles have concerned with momentous curiosity to their good mechanical properties such as tensile and compression strength, hardness, wear resistance etc. Further, assimilation of fly ash provides overall weight reduction & filler material, thereby changeover of aluminium alloy. In this paper an attempt has been made to provide an extensive review on the overall performance of these fly ash reinforced composites manufactured by stir casting technique. Literatures in every paper are analyzed according to the fundamental factors such as manufacturing methods and properties are discussed. The literature review explained in this paper clearly shows the unusual performance of Al alloy and fly ash after reinforcing.

KEYWORDS: Al alloy, fly ash, stirs casting, Tensile strength, wear and hardness etc.

INTRODUCTION:

The automobile industry has been facing considerable technical demands as it look for to get better fuel recession, reduce vehicle emissions and improve performance. It is imperative to reduce the overall weight of the vehicle for improving the fuel economy. Since the clutch represents the rotating masses, the reduction in their weight is essential to increase the vehicle dynamics and acceleration. The possibility to made exchange materials, in order to improve clutch performance and to reduce weight has made the development of advanced materials. Many metropolitan cities require clutch with more energy absorbing capability due to the increased traffic density. Increased speed of automobiles with a demand of fuel economy, vehicle comfort and cost reduction envisages the suitable selection of materials for clutch plates. Thus the need arises for searching a suitable material and designing comparatively smaller and light weight clutch plate.

The use of lightweight materials in vehicles has been increasing as the need for higher fuel efficiencies and higher vehicle performance increase. Steel is the traditional material used for manufacture clutch plates of both light and heavy vehicles. The wide accessibility and the low cost are the advantages of these materials. Disadvantages include its heavy weight, high wear rate, noise and vibration. There has been interest in using aluminium based metal matrix composites for clutch plate and drum materials in recent years. While much lighter than steel, they are not as resistant to high temperatures and are sometimes only used on the rear axles of automobiles because the energy dissipation requirements are not as severe compared with the front axle. In this study, an effort has been made to revision and compares the behaviour of MMC with the conventional steel for brake drum applications.The Aluminium material is found abundant metal in earth's crust and third most abundant element, after Oxygen & Silicon. They are widely used due its properties such as

availability,easy machinability, and high strength to weight ratio, durable, ductile & malleable. Further, Aluminium based MMC have received increasing attention in recent decades as engineering materials due to their superior properties like high strength, hardness and wear resistance over conservative Al alloy. Here, matrix material Aluminium has advantage of lighter weight &major silicon content of alloy may benefits to get better castability.

FLY ASH AS REINFORCEMENT IN AL MATRIX:

Small particles of fly ash (normally of size 0-100micron) which are extracted from residues generated in the combustion of coal in many industries can be used as reinforcement material. As Fly ash has low density, chances of good wettability between the fly ash & matrix Al alloy. The particulate reinforced aluminium matrix composite are gaining importance because of their low cost with advantage like the possibility of secondary processing .The high electrical resistivity, low thermal conductivity and low density of fly-ash may be supportive for making a light weight composites.Fly ash, being a waste material formed as a result of coal combustion in power plants needs ecological processing to avoid its dump ingot waste grounds or landfills.

MANUFACTURING OF MMC:

The stir casting method is promising way for manufacture of MMCs as it follows conventional metal forming way. Since the gas layers at the surfaces of the particles can cause the migration, the method of mechanical stirring can be used to break away the gas layers thereby reducing surface tension of molten Aluminium. Also stir casting technique profits relatively homogenous as well asvery fine microstructure which improves the addition of reinforcement material in the molten metal. In addition, the porosity level of composite minimized and the chemical reaction between reinforcement and matrix avoided. The proper selection of process parameter such as pouring temperature, stirring speed, pre-heat temperature of reinforcement can produce good quality composites.

fig. Setup of Stir casting

The results of the several investigations regarding the fly ash reinforced in aluminum are as follows:

R. V. Adat, S. G. Kulkarni and S. S. Kulkarni[1] , reported that by Aluminum matrix composites have been successfully manufacture by stir casting method with fairly uniform distribution of fly ash and Al2O3 particles. This method is very capable, simple and cost efficient method of fabricating of Aluminium matrix composites and also it is most suitable for mass production. Processing variables includes holding temperature, stirring speed and time, blade design of the stirrer and preheating process are among the important factors to be considered while production of cast metal matrix composites as these have an impact on quality and properties of casting.It is observed that preheating the mould improves the soundness of the casting, shown by a decrease in the porosity level. The pouring distance from the crucible and the mould should be kept short as possible. The wetability between matrix and reinforcement will be improved by addition of magnesium in melt. The nature of fabricated Aluminium metal matrix composite is isotropic due to fairly uniform distribution of reinforcement.

Himanshu Kala, K.K.S Mer, SandeepKumar[2],they states that, Stir casting method can be successfully used to manufacture metal matrix composite with preferred properties. Reinforcing Aluminum and its alloys with ceramics particles has observed an appreciable increase in itsmechanical properties. Addition of alumina, SiC, B4C etc. particles in aluminum improves the hardness, yield strength, tensile strengthwhile ductility is decreased. By the addition of graphite in aluminum increases the tensile strength and elastic modulus but hardness is decreased.Also it shows a decrease in friction coefficient in case of tribological behavior.Organic reinforcements like coconut ash, rice husk ash also improved the mechanical properties of thealuminum along with the tribological behavior of the composite.For Al MMCs with organic reinforcements, very limited work has been testified. Because ofadditions of organic reinforcement to aluminum matrix have shown significant increase in the mechanical properties of resultingcomposites. Though, substantial improvement in the tribological properties has not been achieved in thelimited reported literature in this part. This provides scope for further investigations in the area.A very few authors have reported about modified stir casting methods for improving the well distribution of thereinforcement in the matrix. However, there is a lack of work regarding availability of efficient techniques fornano level reinforcements.It is observed that hybrid ceramic reinforcement has increased the mechanical

properties much but literature on tribologicalproperties in case of hybrid reinforcement is inadequate.

Kesavulu A, F.AnandRaju, Dr. M.L.S.Deva Kumar[3],they concluded that we can use fly ash for the production of composites and can turn industrialwaste. Fly ash up to 20% of weight can be successfully added to aluminium by stir casting methods to producecomposites.The density of aluminium-fly ash is decreased with increase in addition of fly ash and the density will be reduced. Also the hardness of aluminium-fly ash has increased with increase in addition of fly ash.Effect onthe tensile strength of aluminium-fly ash is increased up to 15% of fly ash is added in the aluminium.

Sankar.L, Srinivasan.R, Viswanathan.P and Subramanian.R.[4] reveals that, Development of lightweight materials has provided the automotive industry with numerous possibilities for vehicle weight reduction. Normally the selection of materials in automobiles plays an important role in it. The material which has been selected should have good mechanical characteristic and less in cost. In this experimental study they have suggested that the flyash composites are best suitable for automobile clutch plate compare to the current exiting clutch plate materials. Due to its less coefficient of friction the fly ash composites can be used in automobiles in future.

Vigneshkumar.S, B ,Arivu.Y.[5], states that,the heat loss can be controlled, the oxidation reaction can be avoided and time consumption can be reduced Ifthe stir casting setup is carried in a closed atmosphere in presence of argon & krypton gas.The process of solidification becomes rapid at time of pouring in the die, to avoid that the die is to be preheatedto more or less control the rapid solidification. Temperature maintenance, Solidification rate& proper distribution ofreinforcement are hard even at 25% of reinforcement Because of hybrid composite. The reinforcement of Al alloy with reinforcement particulates upto a volume fraction of 25% has effects on the wear rate. They observed that, the wear rate and coefficient of friction decreases with increasing percentage of reinforcements.The coefficient of friction and wear rates of the hybrid composites are less when compared with the matrix alloyand the individual composites.Hardness of the composite material specimens measured after the wear test increases with the increasing percentage ofthe reinforcements.

Amardeep Singh, Ajay Singh Rana and NirajBala [6]concluded from their studythat,Al + Al2O3 + Fly ash composite was successfully fabricated using cost effective stir casting technique. Hardness of aluminium was increasedconsiderably with the addition of reinforcement, i.e., Al2O3 + Fly ash. The wear resistance was increased significantly with the addition of reinforcements in aluminium. The wear resistance of Al + Al2O3 + Fly ash composite was observed better at load of 40 N and both the sliding velocities of 0.8 m/sec and 1 m/sec than pure Al material. The comparison of wear behavior of specimens at normal load of 40 N revealed that wear resistance of pure Al and Al + Al2O3 + Fly ash composite increased with increase in sliding velocity even though this increase was marginal for pure Al while for Al + Al2O3 + Fly ash composite it was considerable.

Muruganandhan. P, Dr. Eswaramoorthi. M. [7] This paper reviews that the metal matrix composites are very much useful in automobile. It is found that fly ash plays aimportant role in enhancing the mechanical properties of composite material. The review result shows that 10 to 20% increase in mechanical properties. The tensile strength, compression strength and hardness get improved by adding fly ash. The usage of aluminium can be minimized by enforcing the fly ash. The SEM analysis is done to investigate the distribution of fly ash with the composite.It is found that the addition of fly ash acts as a barrier to the movement of dislocations and there by increases the hardness of the composite. By adding fly ash to the aluminium in molten state increases the abrasive wear resistance. This strengthening of the composite is because of the solid solution strengthening, dispersion strengthening and particle reinforcement.

Bharat Admile, S. G. Kulkarni, S. A. Sonawane.[8], this review reveals that, extensive work has been reported to improve properties of different matrices by forming their composites being reinforced with fly ash particle. Fly ash up to 20% wt. can be added in Al matrix. It is found that almost all properties like tensile, compression, hardness, wear etc improved and hence fly ash should be implemented extensively in the commercial production of composites in industries as its use for the production of composites can turn industrial waste into industrial wealth. This is also useful to solve the problem of storage of fly ash as well as brings down the fabrication cost giving reasonable and ecofriendly solution.

Babu Rao, D. Venkata Rao and N.R.M.R. Bhargava [9], they determined by their study, a series of Al - fly ash (ALFA) composites were produced by stir casting route effectively. The large amount of fly ash up to 15% by weight was incorporated successfully into Al matrix by stir casting route. There was a homogeneous distribution of fly ash particles in the matrix phase and also existing a good bonding between matrix and fly ash reinforcements. It is found that the hardness of the composites improved and the density of the composites decreased with increasing the amount fly ash than the pure aluminium material. Improved mechanical

properties were observed with increasing amount of fly ash under compression. From this investigation it was concluded that industrial waste of fly ash was turn into industrial wealth by the production of light weight composites materials; these light weight ALFA composites can be used for automobile industry applications in future.

Vivekananthan M. and Senthamarai k.[10],From their study they concluded that we can use fly ash for the production of composites and can turn industrial waste into industrial wealth. This can also solve the problem of storage and disposal of fly ash. The amount of fly ash up-to 20% by weight can be successfully added to commercially pure aluminum by stir casting route to produce composites. The addition of magnesium and silicon improves the wet ability of fly ash with aluminum melt and thus increases the retention of the fly ash in the composite. Hardness of commercially pure Al is increased from 58BHN to 86BHN due to addition of fly ash and magnesium. The eventual tensile strength has found to be increased with increase in fly ash content. Also ductility has decreased with increase in fly ash content. The effect of increased reinforcement on the wear behavior of the MMCs is to increase the wear resistance and reduce the coefficient of friction. The MMCs showed better wear resistance due to its superior load bearing capacity. The wear resistance of composites is much greater than the commercially pure aluminums.

CONCLUSION:

The review shows that by increasing the weight fraction of fly ash particles, the mechanical properties like tensile strength, compressive strength and hardness were improved and to improve properties of different matrices by forming their composites being reinforced with fly ash particle. It is observed up to 15% wt., fly ash can be added in Al matrix. This also solves the main problem of storage of fly ash. Also it brings down the production cost giving an economical and eco friendly way. From this study it was concluded that industrial waste of fly ash can be used in industrial wealth by the production of light weight composites; these light weight ALFA composites can be used for automobile industry like clutch plate application.

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