A STUDY ON STRUCTURAL BONDING OF FLY ASH WITH OTHER MATERIALS FOR MATRIX COMPOSITES

NAGALLI RAGHU
Research Scholar,
JJTU, Rajasthan.
E-Mail: scholarraghu@gmail.com

DR. S. CHAKRADHAR GOUD
Prof and Principal, Sri Sarada Institute of Science and Technology
E-Mail: cgsakki@yahoo.com

ABSTRACT:
Metal matrix composites (MMCs) constitute a very important category of design and weight efficient structural materials that area unit encouraging each sphere of engineering applications. There has been an increasing interest in composites containing denseness and low price reinforcements. Among numerous discontinuously dispersed solids used, ash is one amongst the foremost cheap and denseness reinforcement obtainable in massive quantities as solid waste by-product throughout combustion of coal in thermal power plants. Hence, composites with ash as reinforcement area unit doubtless to beat the value barrier for wide unfold applications in automotive and tiny engine applications. The current study has been targeted on utilization of waste ash in helpful manner by dispersing it in metallic element matrix to produce composite. in the present work, fly-ash that primarily consists of refractory oxides like oxide, alumina, and iron oxides, was used because the reinforcing section and to extend the wettability metal and semiconductor were superimposed. Composites were made with different percentages of reinforcing section.
Keywords: *ash, MMCs, Bonding ability with alloys.*

INTRODUCTION:

Fly ash is coal combustion by product that accumulates owing to electricity precipitation of the flue gases in thermal station. Once coal is burnt in thermal station the ash is carried forward in flue gases as coalesced particles that solidify as a spherical particle. Most of those spherical particles have a gas bubble at the centre. The constituents of fly ash particles as obtained from coal in United Kingdom of Great Britain and Northern Ireland area unit silicon oxide (59.5%), corundum (20.3%), FeO /Fe2O3 (6.5%), remaining being FeO, MgO and un-burnt coal etc. ash relying upon the supply of coal contains completely different proportions of silicon oxide, alumina, oxides of iron, calcium, atomic number 12 etc. alongside parts like carbon, Ti, Mg, etc. that the ash has properties combined of spherical particles which of metals and metal oxides. Filler materials area unit usually the inert materials that area unit utilized in composite materials to cut back material prices, to boost mechanical properties to some extent and in some cases to boost method ability. Mixing of chemical compound materials (PVC & PVB) ends up in accumulated impact strength. Reinforcement of chemical compound matrix with optical fibre ends up in general improvement of mechanical properties. Chemical compound matrix composites area unit utilized in greatest diversity in lightweight of their less price, easy material ability, higher specific strength, style flexibility and light-weight.

CASE STUDIES AND REVIEWS

Case-1:

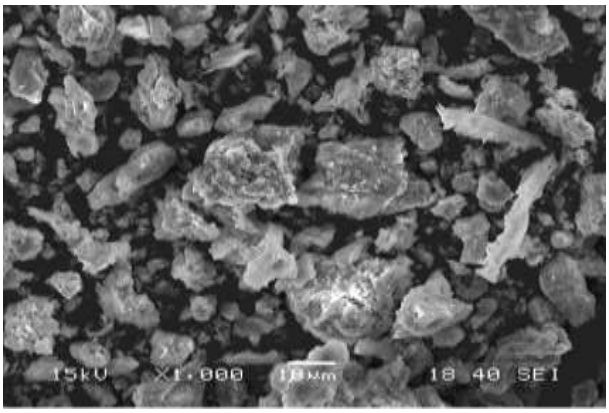
Fly-ash that chiefly consists of refractory oxides like silicon oxide, alumina, and iron oxides is employed as reinforcing part. Composite was created with 10gm to40gm fly-ash as reinforcing part. Commercially pure Al was additionally liquefied and

casted. Then particle size and chemical composition analysis for fly-ash was done. Mechanical, physical and grain properties of the composite were evaluated and compared with the commercially pure Al. Mechanical properties of composites are tormented by the scale, form and volume fraction of the reinforcement, material and reaction at the interface. These aspects are mentioned by several researchers. P.K. Rohatgi reports that with the rise in volume percentages of ash, hardness worth will increase in Al–fly ash (precipitator type) composites. He additionally reports that the tensile modulus of elasticity of the ash alloy will increase with increase in volume % of ash. J. man Rao studies that Metal matrix composites (MMCs) possess considerably improved properties compared to unreinforced alloys. There has been associate degree increasing interest in composites containing rarity and low price reinforcements. Among numerous dispersions used, ash is one in all the foremost cheap and rarity reinforcement on the market in giant quantities as solid waste by-product. Within the gift investigation, pure Al – five to fifteen (by weight) ash composites were created by stir casting route. P. Shanmughasundaram studied the event of light-weight materials has provided the automotive trade with varied potentialities for vehicle weight reduction. Progress during this space depends on the event of materials, process techniques; surface and warmth treatments Al matrix ceramic reinforcement composites have attracted increasing attention as a result of their combined properties like high specific strength, high stiffness, and low thermal enlargement constant and superior dimensional stability at elevated temperatures as compared to the monolithic materials.

Case-2:

Chemical reaction between al and fly ash

The thermo dynamical analysis indicates that there is possibility between the reaction of Al melt and the fly ash particles. The particles contain alumina, silica|silicon dioxide|oxide} and iron oxide that throughout solidification|natural action|action|activity} process of Al ash composites or throughout holding such composites at temperature on top of 8500 C, area unit seemingly to bear chemical reactions, rumoured by P.K.Rohatagi and Guo. The experiments indicate that there's a progressive reduction between SiO2, Fe2O3 and mullite by Al and formation of Al2O3, Fe and Si. The wall of chemosphere ash particles progressive disintegrates into separate particles into the reaction progress.



Micro Structure of fly ash

The preference to use ash as a filler or reinforcement in metal and compound matrices is that ash may be a by-product of coal combustion, offered in terribly massive quantities at terribly low prices since abundant of this can be presently land stuffed. Currently, the employment of factory-made glass small spheres has

restricted applications due chiefly to their high value of production. Therefore, the fabric prices of composites are reduced considerably by incorporating ash into the matrices of polymers and auriferous alloys. However, little info is obtainable on to assist within the style of composite materials, even if tries are created to include ash in each compound and metal matrices. Cenosphere ash features a lower density than talc and carbonate, however slightly beyond hollow glass. the price of chemosphere is probably going to be abundant not up to hollow glass .Chemosphere could end up to be one amongst rock bottom value fillers in terms of the price per volume.

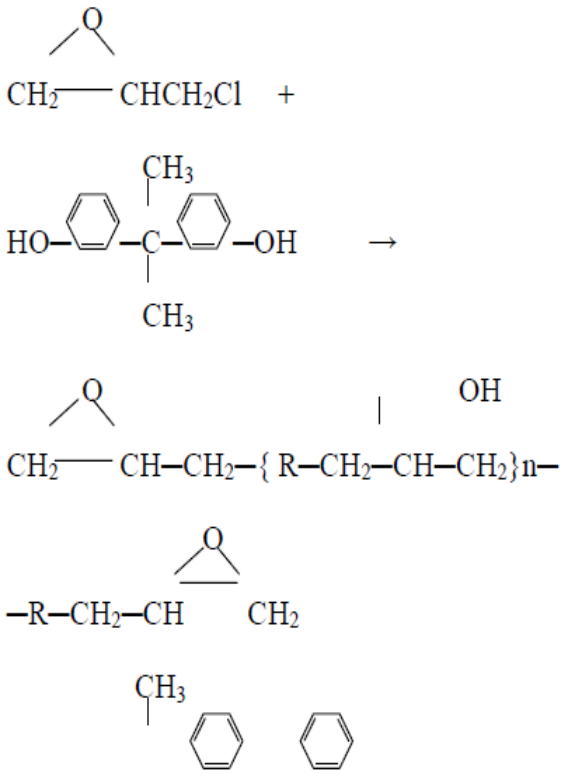
Classification on the basis of Chemical Composition: Fly ash is a pozzolanic material and has been classified into two classes, F and C, based on the chemical composition of the fly ash. According to ASTM C 618, the chemical requirements to classify any fly ash are shown in Table

Properties	Class F	Class C
Silicon dioxide (SiO_2) plus aluminum oxide (Al_2O_3) plus iron oxide (Fe_2O_3), min, %	70.0	50.0
Sulfur trioxide (SO_3), max, %	5.0	5.0
Moisture Content, max, %	3.0	3.0
Loss on ignition, max, %	6.0*	6.0

Case -3:

Epoxy resins;

Epoxy resins are the most commonly used thermoset plastic in polymer matrix composites. Epoxy resins are a family of thermoset plastic materials which do not give off reaction products when they cure and so have low cure shrinkage. They also have good adhesion to other materials, good chemical and environmental resistance, good chemical properties and good insulating properties. The epoxy resins are generally manufactured by reacting epichlorohydrin with bisphenol. Different resins are formed by varying proportions of the two: as the proportion of epichlorohydrin is reduced the molecular weight of the resin is increased.



Raw Material Used

Fly ash:- Silica (59.5%), Alumina (20.3%), FeO /Fe2O3 (6.5%), remaining being FeO, MgO and un-burnt coal etc.

Epoxy resin:- Araldite- LY- 554 1.10 – 1.15 gm/cc

Hardner :- HY-951 0.97 – 0.99 gm/cc

Glass fiber:- E-glass (E-300) Mat 2.54 gm/cc.

Fly ash in fibre matrix

RESULTS IN DIFFERENT CASE STUDIES

Case-1

Toughness of the composites was determined by using Izod and Charpy tests. As we have a tendency to increase the number of ash the toughness worth step by step enlarged up to some level i.e Sample2 however when this it diminishes. b) Hardness and lastingness of the composites additionally showed similar results as like of toughness. As we have a tendency to enlarge the number of ash up to Sample2 it will increase and at that time goes down. c) The density of the composites attenuated with increasing ash content. Therefore these lightweight weight composites are often used wherever weight of associate degree objects maters as like within the aero and area industries. From the on top of results we discover the Sample2 having associate degree smart toughness, hardness, lastingness and additionally having the tenuity relatively alloys while not reinforcement. in order that these composites may well be employed in those sectors wherever lightweight weight and smart mechanical properties square measure needed as like in automobile and area industries

Case -2

From the study it is 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. Fly ash up-to 20% by weight can be successfully added to commercially pure aluminum by stir casting route to produce composites. Addition of magnesium and silicon improves the wettability of fly ash with aluminium melt and thus increases the retention of the fly ash in the composite. Hardness of commercially pure aluminium is increased from 58BHN to 86BHN with addition of fly ash and magnesium.

The Ultimate tensile strength has improved with increase in fly ash content. Whereas ductility has decreased with increase in fly ash content.

The effect of increased reinforcement on the wear behaviour of the MMCs is to increase the wear resistance and reduce the coefficient of friction. The MMCs exhibited from the study it's concluded that we can use fly ash for the production of composites and may turn industrial waste into industrial wealth. This can also solve the problem of storage and disposal of ash. Ash up-to 200th by weight can be with success other to

commercially pure metallic element by stir casting route to supply composites. Addition of Mg and atomic number 14 improves the wettability of ash with Al soften and therefore will increase the retention of the ash within the composite. Hardness of commercially pure Al is increased from 58BHN to 86BHN with addition of ash and Mg.

The final durability has improved with increase in ash content. Whereas plasticity has weakened with increase in ash content.

The impact of increased reinforcement on the wear and tear behaviour of the MMCs is to extend the wear and tear resistance and cut back the constant of friction. The MMCs exhibited higher wear resistance thanks to its superior load bearing capability.

The wear resistance of composites is far bigger than the commercially pure Al. better wear resistance due to its superior load bearing capacity.

The wear resistance of composites is much greater than the commercially pure aluminium.

Case -3

With the addition of fly-ash in epoxy resin–fly-ash composite the compressive strength has been found to increase with increase in fly ash particles. This increase is attributed to hollowness of fly-ash particles & strong interfacial energy between resin & fly-ash. After reinforcing glass fibre both compressive & impact strength has been increased due to energy absorbed in fibre pull out. In SEM analysis it has been found that fly-ash particles have been uniformly segregated.

CONCLUSIONS

By studying different cases it has been observed that fly ash is one adorable content will won't to prepare matrix materials for various applications. Although some researches on ash created some deep studies includes NANO fly ash preparation and its usages it concludes that application oriented researches need to be done for further clarifications.

REFERENCES:

- *National Report on Thailand Outstanding Technologist Award By Foundation of the Promotion of Science and Technology under the Patronage of H.M. the King, BKK, Thailand, October, 2002.*
- *Chand N. SEM observations of fractured fly-polyester composites. J Mat Sci Lett 1988;7: 36–8.*
- *Kishore, Kulkarni SM, Sharathchandra S, Sunil D. On the use of an instrumented set-up to characterize the impact behavior of an epoxy system containing varying fly ash content. Polym Test 2002;21: 763–71.*
- *Mohanty Samrat, Chugh Y.P., Development of fly ash-based automotive brake lining, Tribology International 40 (2007): pp. 1217–1222*
- *Rohatgi P.K,Weiss D, and Gupta Nikhil, Applications of Fly Ash in Synthesizing Low-Cost MMCs for Automotive and Other Applications, Journal of the Minerals, Metals and Materials Society, vol 58,(2006): pp 71-76*