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REVIEW ON COAL COMBUSTION WASTE FLY ASH TO CONSTRUCT HEAT RESISTIVE AND CONDUCTIVE MATERIAL

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ORIGINAL ARTICLE

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Abstract :-

The research in preparation of heat resistive & conductive materials by solid solution heating methods using alkali activated coal FA (40-45%), waste glass as siliceous (50%) soluble with HF, some organic additives(1.5%) and cellulose (3.5%) as binder. A very small amount of binder as cellulose acts to support the increasing in binding character between additives of molecules. The system of heat energy acts in sense and effect of materials in nature. The successfully masters i.e. time attains the fundamental notions of motion in which space is a pattern of matter affecting the substance, changes of both qualities and quantities, values increases or, decreases etc. The succession of modern science & technological thought by logical process i.e., the term always contains high potential in states of matter depends on flow of amount of energy in a system, which referred to as a "gradient"(storing the useful energy). The 'energy' possibly and particular in Eastern and Western civilizations has been presented in a greatest continuous chain for developing human civilization behind the stability of material objects and

transforms the various materials form. In Battery Bank, energy stored with the capability of material that chosen the better quality from treatment of heat insulation and conduction materials based on waste coal combustion of fly ash with waste glass and some additives. First of all, material's resistive and conductive that heat depends on chemical composition of FA, WG itself. From this typical point, the FA could also be reflect the heat by using WG. For water absorption i.e., 24 hr soaking in cold water & 3 hr in boiling water. The production of this material by the thermal treatment individually as (1000 – 1300) ÚC. The mechanical durability with other physical and chemical properties for this material is environmental that supports to it.

Keyword :-

Waste fly ash, siliceous materials, gradients, cellulose, heat resistive, heat conductive, organic additives.

Introduction :-

Any substance, which are generating after primary use and produced useless materials with defective consumption as the waste material i.e. Fly Ash are required to treatment for the purposes a new material for heat resistive and conductive for anticorrosion paint, electrode or, separator of batteries, plate of capacitors etc. In general, the small particle size with higher reactive resistive but heat conductive materials are mixed in the form of oxides is known as fly ash produced from using any material by thermally. From Thermal power plant by electrostatic precipitators, the fly ash collected separately with their fine fly ash ranges which are more valuable in high value of application after studying their mixing characters of oxides. There are generally three categories of coal ashes from Thermal power plants. Such as

- Dry fly ash (collected from flue gas by electrostatic precipitators)
- Bottom fly ash (collected from bottom of the boiler furnaces)
- Pond ash (fly ash & bottom ash mixed together with water and deposited in pond.

Components	Percentage %
SiO_2	54.2
Al_2O_3	25.13
Fe_2O_3	11.72
CaO	3.57
MgO	1.2
K_2O	0.76
Na_2O	0.31
TiO_2	1.1
P_2O_5	0.6
Mn_2O_3	0.2
SO_3	0.35
LOI	0.86

Fly ash is produced by coal fired electric and steam generating plants that coal is pulverized and blown with air into the boilers combustion chambers where it immediately ignites, generating heat and produce molten mineral residues. And boiler tubes extract heat from the boiler, cooling the flue gas and causing the molten mineral residues to harden and form ash. As coarse ash particles, referred to bottom/ slag that falls to the bottom of combustion chamber and lighter fine particles which is termed as fly ash remain suspended in the flue gas. Currently, over 22 million tons of Fly Ash used in PCC (Portland Cement Concrete), soil, road base stabilization, flowable fills, paint materials, coating materials etc. It is commonly used as an polozoan are siliceous & aluminous materials which finely divided in the presence of water and react with calcium hydroxide at ordinary temperature. The minerals, Quartz survives the combustion process and remains quartz in ash. Other minerals lose water and melt and forming alumino-silicate crystalline and non-crystalline materials. Some oxides are mixed to each other that given above of the data table. The emerging material that has huge of potential like oxide materials in fly ash having high electrical resistivity as shown in above of introduction table. This electrical resistivity of oxides is oxide effect for new type of device to store energy. The materials that acts as solving the problem of regular and continuously discharging ions from various cell in shorter to longer time. The experimental capacity of electrode which is slowly diffusing from electrode materials for large particles with lower capacities in electrode. The main purposes is modifying the surface of electrode materials for mass transfer , paint materials as anticorrosive for heat retardment. And there is no discharge of ion by using oxide materials. It means oxide material i.e, MgO, ZnO, BaO, CaO, MnO, SrO, etc mixed combining with fly ash that coating any selective oxides which stop the discharging of ions from cell. Another improvement in qualities as there is some siliceous compounds as quartz in combine with fly ash and some unusable waste glass material use for this purposes. From this advantages the device improves its qualities in stopping the discharge ion.

The fly ash has dual nature such as heat conductive and resistive. As Oxide fly ash has not only electrical resistivity but also electrically conductive in aqueous solution. It means if we wash the fly ash in water, then it soluble and the alkali ions move randomly in the solution. And the mobile ions conduct current and heat. From this concept, the material in fly ash is the best development for insulating matter and conducting matter in bank of battery, capacitor and anti corrosive materials. Purely utilization of coal ash (oxides) and waste glass acts as quartz. The improvement in the rate of capabilities for energy consumption and protect the material from harmful effect; the utilization in electrochemical cell. And we know that, energy is a key factor for human kinds in series from ancient civilization to bright scientific platform of future; which is applied for us by storing the energy in intelligent electrochemical cell. According to commercial purposes, this material is more cost effective than other materials due to utilization of waste products (coal fly ash, waste glass).

Now a days, the main problem i.e, discharge of ions from consume energy and the action of waste material as waste glass and coal combustion of fly ash. It is solved in balancing form of advance research and scientific thought for which is the first type choice for this paper challenging to solve the problems.

We know that fly ash are composed of various oxides, silicates in pure state of high degree of resistive that the major role for stopping the discharges of ion which have suddenly or, slowly leakage/passed out from the bank of storing device, that the discharging or, leakage of acid and recycling after primary use in waste from focuses as less by treating in sufficient characters and property of disadvantages of batteries as waste products in material science. The resistivity is the inverse of conductivity that deals with poorly conductivity/insulating materials. At room temperature the ash particles adsorb considerable from the atmosphere and relatively low resistance. In here the effect arising adsorbed films of moisture that increasing conducting by using the insulating (surface). As material heated, then the resistivity increases that shown by the curve of temperature /ionic conductivity in particles of fly ash. Conducting nature of fly ash arises when it mix with water (aq. solution), some ions moves; randomly inside of the system which conduct electricity. The maximum value of resistivity occurs at temperature that decreases in conductivity due to loss of moisture from the particle surfaces in counter balanced by by increased conductivity due to using temperature.

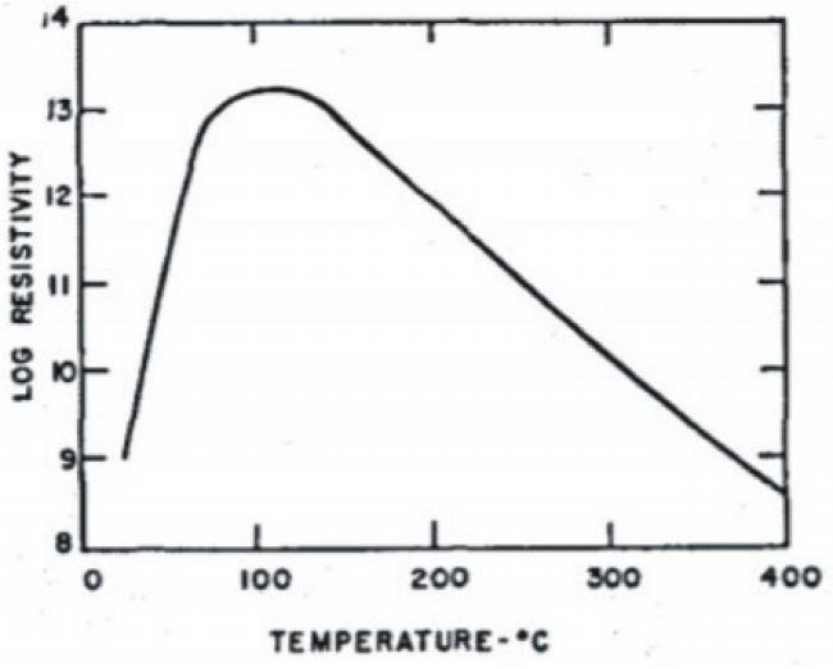

Fig (1): Fly ash resistivity are seen to range($10^{8} - 10^{11}$)ohm-c.m.

The complex mixture attains in the fly ash as of higher in organic compounds that's order of $10^{14} - 10^{15}$ohm-cm resistivity. The chemical substances specifically responsible for conductivity in fly ash was initiated in 1946. The conductivity factor is water soluble, that reduce the resistivity by chemical effective substance in solution of water to use in wash the ash. It comprised small quantities of alkali also present. At gas temperature in the range at least (150 to 350)ÚF,lowered the resistivity in small amount of fume. As small amount of acid used by wt. 0.4% of ash used was required to reduced the resistivity of ash to 10^{10} ohm-cm on lower. This is plotted between temperature versus resistivity for varying amounts of Sulfuric acid.The percentage of Sulfuric acid indicates the valuable curves are reacting to the weight of ash as gas temperature is a parameters of this graph.

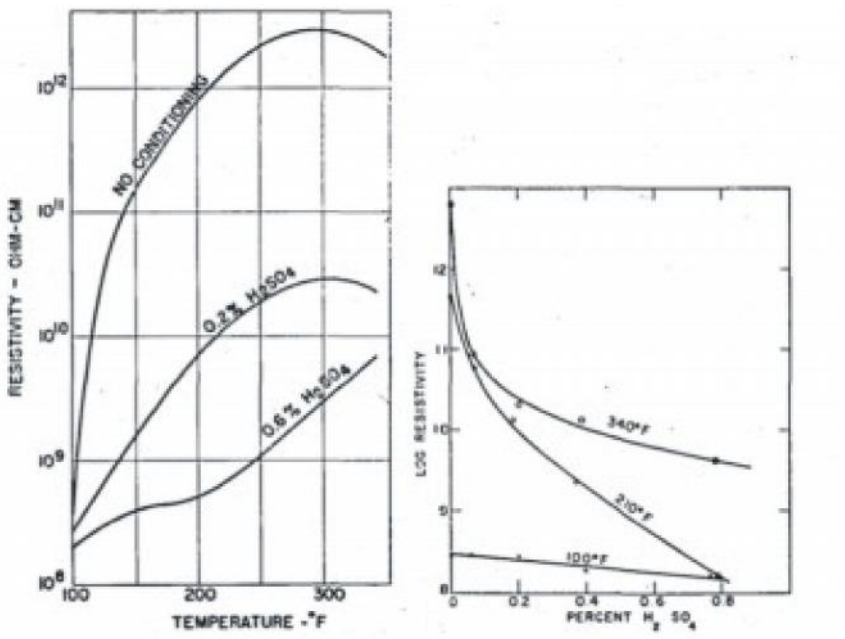

Fig (2): Variation temperature versus resistivity and % of acid and log resistivity

Variation of acid amount in ash, there is effective in reducing resistivity from fly ash as shown in table. Amount of sulfuric acid adsorbed on conditioned fly ash in laboratory test. We obtained from above of the table about conditioning effects observed as-

a) The reduction in resistivity which operates with high voltages introduce.

b) Fraction of acid used in fly ash which lowered the resistivity and conductivity arises.

The main role of this materials, which utilizes the waste materials of fly ash and siliceous waste glass materials in this concept.

In fact, waste glass containing silica which soluble in HF that mixing with FA that rapidly works. Various types of binders (polymeric materials) are used with FA. The FA changes the microstructure during mixing with siliceous compounds by the action of HF. And it is observed that the properties of newly wet materials mix up with binders (3.5%) and some organic additives. One of the main reasons that the production of superior heat resistive materials is related with electrical conductivity by the pore structures in materials. This property only depends upon the degree of crystallization. The crystalline structure shows the high conduction of heat as depends on different composition of percentage in mixing of materials. The utilization of waste glass as additional materials that is best amorphous materials for resist the heat property in case of waste FA. After mixing and heating the WG and FA , we get the porosity that formed by releasing the gas from heating the materials. Now the impure material kept in furnace for construct at (1000 to 1300)ÚC

Review of Literature

In the year 2000, S.I. Abu-Eishah et al., he found the co-relation of metals by thermal conductivity with function of temperature. In result the thermal conductivity of pure metal measure at T< 1.5 Tm.

In the year 2012, Dmitar Zoric et al., construct a light weight thermal conductivity material from coal fly ash. For making this material, he used waste glass, fly ash and cellulose as a polymeric binder. In result, this material has lowest value of interparticle porosity, mechanical property and satisfactory value of thermal conductivity as = 0.0872 W/mK

In the year 2012, Erik S. Toberer et al., discuss about advance in thermal conductivity materials. In this paper, he theorizes the heat conduction of general material classes, characterization techniques for measuring thermal conductivity, and highlighting about new materials morphology develop with unprecedented thermal transport properties.

In the year 2014, Ji- Hwan lee et al., gave a review on thermal conductivity data on nanofluids. In this paper he discuss about physical mechanism models for nanofluid.

In the year 2015, Ravi sankar et al., gave a review on the nanofluid thermal conductivity. The fluid which means the particle are in nano size. The thermal conductivity depends upon the particle siz, volume fraction and temperature.

In the year 2016, M.criado et al., gave the corrosion behavior of coated steel rebars in carbonated and chloride-contaminate alkali-activated fly ash mortar is more efficient against rebar corrosion than ordinary portland cement mortar.

In the year 2016, Acar et al., recovered the potential of cenosphere from bituminous coal fly ashes. For this he use various wet and dry separation process. For this reason he collect fly ash from catalagzi and sugozu. In result fly ash of catalagzi contain11.30% and sugozu fly ash contain 4.50% cenosphere. By wet saving process 90% cenosphere recover and 47% yield for catalagzi fly ash and 81% cenosphere recovery and 30% yield for sugozu fly ash. This cenosphere used in ceramic , plastics and construction material for improved the properties.

In the year 2016, patel et al., gave a review paper on thermal conductivity measuring by different methods. He discuss about finite element method , transient plane source method , sintering of reaction bonded silicon nitride method and Transient method for measuring thermal conductivity of materials.

In the year 2016, Rene et al., used hot insulated plate methods for measuring thermal conductivity of composite materials. He used charcoal, sugar cane, first drying Portland cement and distil water. To extract organic fibre, 250 gm charcoal from sugar cane Bagasse was placed in the drying oven at 400 for 2 hours. He obtained composite materials based on portland cement . In this materials the concentration about 5%, 10%, 15% by weight. Then by hot plate method and SEM measured the thermal conductivity of this materials. In this result , the composite materials has lowest thermal conductivity. By increasing the particle size of material , the thermal conductivity decreasing.

In the year 2016, Maciej et al., characterized cenospheres of fly ash , cenospheres means hollow ceramic microsphere balls. In result , the cenospheres diameter about (10 to 1000) m and its contain (25-27)% alumina.

In the year 2016,Wei et al., recycled high aluminium fly ash for manufacture low cost ceramic membrane supports. He fabricated the ceramic membranes by in-situ sintering method. This membrane supports with (15-25) CaCo sintered at te range of shows the high open porosity over 30% .In result, this membrane has controllable pore size , high porosity and good strength. It is used for microfiltration. In the year 2016,Chen - Chen li et al., prepared mesoporous silica by using coal fly ash . For materials preparation, he used sol-gel method. Mesoporous silica has specific surface area as high as 585.02 and pore volume of 0.54. It's has wide at applications and low cost materials.

In the year 2017, Sett Rupnarayan et al., reported about fly ash, the major solid waste product that particulate pollutant derived from the combustion of pulverized coal in thermal power plants. It affects the vegetation directly and indirectly. The disposal of fly ash continue to be one of the major national problem. In here suggests about research and development units that active and trying to innovative methods to reduce the fly ash pollution with sophisticated techniques like ammonia prevention technology.

YEAR	RESEARCH SCHOLAR NAME	RESEARCH TOPIC	PREPARATION METHOD	RESULT
2000	S. I. Abu-Eishah	The co-relation of metals by thermal conductivity with function temperature.		The thermal conductivity of pure metal at T<Tk.
2012	Dmitar Zoric	A light weight thermal conductivity material from coal fly ash.	Solid solution heating method	This material has lowest value of interparticle porosity, thermal conductivity = 0.0872 w/mk.
2012	Erik S.	Toberer advance in thermal conductivity.		Highlighting about new materials morphology develop with unprecedented thermal transport properties.
2014	Ji-Hwan	Review on thermal conductivity data on nanofluids.		He discuss about physical mechanism models for nasnofluids.
2015	Ravi Sankar	Review on nsnfluid thermal conductivity.		The thermal conductivity depends upon the particle size, volume fraction and temperature.
2016	Chen-Chen Li	Prepared mesoporous silica by using coal fly ash.	Sol- Gel method	Mesoporous silica has specific surface area as high as 585.02 and pore volume of 0.54. It's has wide application. It is low cost materials.

YEAR	RESEARCH SCHOLAR NAME	RESEARCH TOPIC	PREPARATION METHOD	RESULT
2016	M. Criado	The corrosion behavior of coated steel rebars in carbonated and chloride-contaminate alkali-activated fly ash mortar.		carbonated and chloride-contaminate alkali-activated fly ash mortar is more efficient against rebar corrosion than ordinary portland cement mortar.
2016	Acar	Recovered the potential of cenosphere from bituminous coal fly ashes.	Wet and dry separation method	In result fly ash of catalagzi contain11.30% and sugozu fly ash contain 4.50% cenosphere. By wet saving process 90% cenosphere recover and 47% yield for catalagzi fly ash and 81% cenosphere recovery and 30% yield for sugozu fly ash. This cenosphere used in ceramic , plastics and construction material for improved the properties.
2016	Patel	Review paper on thermal conductivity.	Finite element method, transient plane source method etc.	In this paper he discuss about the masuring methods of thermal conductivity of materials.
2016	Rene	Measure thermal conductivity of composite materials by hot plate method.	Hot-plate method	The composite materials has lowest thermal conductivity. When increasing the particle size of material thermal conductivity decreasing.
2016	Maciej	characterized cenospheres of fly ash.		In result, the cenospheres diameter about (10 to 1000) m and its contain (25-27)% alumina.
2016	Wei	Recycled high aluminium fly ash for manufacture ceramic membrane support.	In- Situ Sintering method	The membrane has controllable pore size, high porosity and good strength. It is used for microfiltration.
2017	Sett Rupnarayan	Characterization of fly ash		Research and development units that active and trying to innovative methods to reduce the fly ash pollution with sophisticated techniques like ammonia prevention.

Methodology :-

The heat resistive and conductive materials were made from waste fly ash, waste glass, organic additives and definite quantity of HF which prepared as following procedure.

In order to shaping the mixture of FA, WG finely by polymeric cellulose as binder with suitable compositions. By the help of laboratory apparatus, the substance of definite amount of mixture initiating to pelletization by hydraulic pressure machine. And the pellets would be dry with temperature at 100ÚC for 5 hr by calibrator. After all, it is fired at muffle furnace at (1000-1300)ÚC. The image of cross section in materials detect by SEM methods, TC in guarded hot plate of measurements.

Conclusion & Suggestion :-

From this above review paper we conclude that :-

Heat Conductive & Resistive Material :-

Materials which conducts heat is called as thermal conductivity and resist the heat as insulation of materials. Actually the heat transfer in materials like water flows in empty pipe with lower and higher rate depends on materials particle size. The reciprocal of thermal conductivity is also called as thermal resistivity. The transport of energy in constant rate gives the flux from high to low temperature. In materials the microscopic structures and atomic interactions develop the the conduction and resistive rate in materials. In present, the coal FA having different oxides , high resistive WG are main component to construct the materials. The porosity, compressive strength, molecular size and interaction between particles at (1100 -1300)ÚC are main properties for heat conduction and resistivity of materials.

The advancement and manage the waste materials that contribute the biggest problem solved to investigate the utillization of waste materials like FA ,WG through this review paper. According to this review , the main conclusion marked as,

a) The waste materials utilization such as WG, FA in heat conductive and resistive materials can be focused extensively due to generating eletricity from coal thermal power plant.

b) The method for determine the thermal conductive by guarded hot plate ,which determine the accurate in TC .

c) The production of materials depends on different types of speciman that utilize mainly in devices like capaitor ,battery ,anticorrosive , paint ,materials .

d) The thermal conductivity and restivity are reciporcal in nature,since thermal conductivity depend upon prosity temperature particals size water absorbtion are main relative environmental charactertics parameters.

Fly ash is a waste material but its used in many purpose. By this use of FA & WG, the low cost material is Produced.

From this above review we suggest that when we produced thermal conductive and resistive material produced. FA is used in this purpose then a maximum amount

of FA & WG is utilized. Waste materials are used in research work then produced materials, becomes a new era in reseacrh. And also our environment keeps safe from this harmful waste materials. This thermal conductive materials has wide range of use such as in electronics, save energy, geologicaly, nanomaterials, polymers etc.

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