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Real Study on Fly Ash Polymer Composite

Sumit[1], Abhishek Arya[2]

[1]M. Tech. Student, Matu Ram Institute of Engineering and Management College (M.R.I.E.M), Rohtak
[2]HOD of Civil Engineering Department in Matu Ram Institute of Engineering and Management College), (M.R.I.E.M), Rohtak

ABSTRACT

Fly-ash is mixed with Cold setting resin at different| proportions and water treated at different temperatures to search out out an answer to the brick trade. The compressive strength, Hardness, water absorption, Density and thermal physical phenomenon of the Fly ash -resin powder bricks obtained below optimum test conditions are eleven.24 MPa, 47.37HV, 19.09% 1.68 g/cm3, and 0.055 W/mK respectively. The sliding wear behavior is also investigated. The structure-property correlation of those composites are studied using X-ray diffraction, FTIR analysis and scanning electron microscopy.

Keywords: Fly Ash, Strength, Mixing, Resin, Bricks, Polymer, Composite

INDRODUCTION

Fly Ash

Fly Ash is an Industrial waste that is accepted as an environmental waste material, generated throughout the combustion of coal for energy production. once the coal is discharged within the grate of a boiler, Carbon and volatiles materials fully burnt off. But still, some inorganic impurities of earth parts (sand, Feldspars etc.) are bonded along and are discharged out through flue gases. once these amalgamated materials are allowed to solidify, it ends up in the formation of fine and spherical particles known as Fly ash

Cold setting resin: -

Cold mounting compound resin is used as a binder material to provide inter particle bond between the Fly ash particles and to increase their strengthening effect. They are good resistance to atmospheric and chemical degradation. Resin powder cannot shows its effect alone until it is mixed with hardener (or accelerator) to provide the mounting compound, and then the polymerization process takes place to form the desired block. This process sometimes generates heat but this generation can be minimized by the use of cool air or cooling water. These compounds can be ideally chosen for those materials which show sensitivity towards heat or pressure. This cold setting resin offers better properties for Fly ash compacts. Improved mechanical strength and hardness, resistance to atmospheric and chemical degradation, reduced thermal conductivity, eliminates porosities and cavities.

Objective of the Present work

The aim of the present work is to fabricate Fly ash polymer composite at different proportions of polymer and to study physico mechanical, thermal conductivity and wear behavior. In present project an attempt was made to increase the density and hardness of the water cured cylindrical samples. SEM, XRD and FTIR analysis is done to investigate the microstructural changes

Experimental work and methodology

Analysis on the performance of ash at numerous states is essentially needed before its usage. therefore to understand the characteristics features of Fly ash , experiments can not be performed on field domain. there's no any alternate choice except research laboratory test to assess its importance. The analysis conducted in laboratory provides a calculating approach to control many parameters that come upon during practice. Brief description of the types of material used, sample preparation and its characterization through SEM, XRD, and FTIR, Mechanical and surface properties like Compressive strength, Hardness and wear resistance, Thermal conductivity measurement and others are outlined in this section.

Hardness

Vickers hardness tester (LECO, LM 248AT) as shown in Figure 1. was used to find the hardness values of all the dry and wet samples using 20 gf Load for a dwell time of 15 seconds. At least eight measurements were taken at different position for each sample in order to get constant results.

Fig 1: Vicker hardness tester

Compressive Strength

In order to measure the compressive strength of dry and wet samples INSTRON 1196. Prior to test, gauge length and gauge diameter of the dry and wet specimens were measured individually by the aid of Vernier caliper .The tests were carried out at room temperature (300 K) with a constant crosshead speed of 1mm/min and the full scale range load of 50 kN. This computer integrated machine gives the Load vs displacement signals directly when the specimens were subjected to tests.

Wear resistance and Friction

In this study computerized Ball on Plate Wear Tester (TR-208-M1) as shown in Fig was used to evaluate the wear performance and sliding contact resistance of the Fly ash compacts.

Fig.2: Ball-On-Plate Wear Tester (TR-208 M1)

The experiment was carried out with the help of 4 mm diamond indenter keeping the different track radius of 4 and 8 mm respectively. Prior to wear, constant normal load of 10 and 20N was applied. The indenter rotates on fly ash compact with a constant speed of 20 rpm for different time period of 600s. At the end of each test, loss in weight of the samples was noted. Results obtained have been expressed in terms of wear depth, and friction co-efficient.

RESULTS

Composition of Fly ash

Fly ash mainly consists Silica (Sio2), Alumina (Al2o3), Calcium Oxide (CaO), and Iron Oxide (Fe2O3).The chemical composition of Fly ash is tabulated in table 1.

Table1: Compositional analysis of Fly ash

Compounds	SiO2	Al2O3	CaO	Mgo	P2O5	Fe2o3	SO3	K2O	LOI
Composition (%)	54.5	26.5	2.1	0.57	0.6	-	-	-	14.18

Water Absorption Test

The amount of water absorbed corresponding to different FLY ASH composition. The water absorption values of FLY ASH composites lies in the range of 15.55 % to 19.09%. It can be seen that all the composition met the absorption criteria set by several developing countries. In India maximum of 20 % water absorption permits when compacts are immersed for 24 hours.

Table 2: Percentage (%) water absorbed by various fly ash polymer compacts

Mix Composition (Wt. %)	Weight (gm)		Water Absorption (%)	Average Water Absorption Value (%)
	Dry	Wet		
(FLY ASH)75%+ (RP)25%	4.579	5.302	15.78	15.55
	4.630	5.340	15.33	
(FLY ASH)80%+ (RP)20%	4.452	5.151	15.70	16.61
	4.642	5.456	17.53	
(FLY ASH)85%+ (RP)15%	4.502	5.356	18.96	19.09
	4.329	5.162	19.23	

Fig.3 shows a relation between the amount of water absorbed and density of dry composite with respect to Fly ash composition. It is evident from the graph that the water absorption increases with increase in Fly ash content. 85wt. % Fly ash absorbs water to a maximum of 19.09%. This indicates that that most of the openings of the compacts are open to outside.

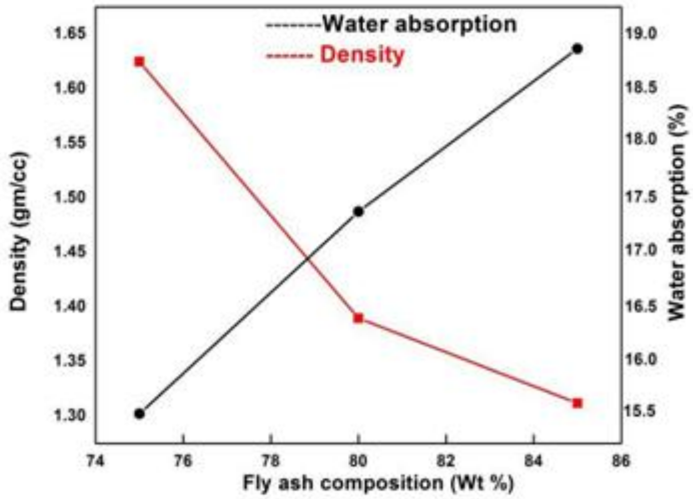

Figure.3: Water absorption and density as a function of FLY ASH Composition

CONCLUSIONS

On the basis of present study following conclusion can be drawn:

1. Thermal conductivity of FLY ASH increases with increase in temperature, whereas in case of resin powder Fly ash mixes, the conductivity of composite decreases with increase in temperature. A lower conductivity value is achieve and thus can be used as a substitute material with respect to clay.

2. Water absorption increases with increase in Fly ash content. Maximum of 19% water is absorbed in case of 85 wt. % Fly ash

3. Density of dry compacts decreases with increase in Fly ash content. While in case of wet compacts, it increases with increase in Fly ash content.

4. SEM analysis revealed the morphology of Fly ash particles that are mostly spherical in shape. With decrease in polymer addition i.e. increase in Fly ash content the interFly ash ce bonding becomes better and less amount of cracks were found at the interFly ash ces.

5. XRD analys is exposed that Fly ash particles mainly consist of Silica and alumina with less percentage of Fe2O3, Cao and others.

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