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Percentage of water absorption in a Cenosphere solid discs with Talc

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Abstract

Cenosphere also known as Hollow Ceramic Microsphere and trade names like Cenolite, Spherelite and Lifefilletc Standard Grades. Cenosphere is a glass hard, inert hallow silicate spheres. In India, the main source of electricity is coal fired thermal power plants. The huge amount of fly ash (cenosphere) is generated by this power plant. In the present paper, we see the cenosphere disc which is the mixture of fly ash-talc with porous material (Napathalene) and 10 % sodium hexa meta phosphate (SHMP) added to the mixture. As increase in the talc percentage, the absorption of water is decrease while the porous material (Napathalene) is added upto 60% the absorption of water is gradually starts increasing.

Keywords: Fly ash, membrane, naphthalene, absorption, SHMP.

Introduction

Approximately 75% of India's electricity is produced by burning coal in thermal power plants, while hydroelectric production accounts for 20% , and the 5% remainder is provided primarily by nuclear, solar and wind power coal burning leads to the generation of enormous amount of solid waste in the form of fly ash.

Cenospheres are hollow aluminium silicate microspheres obtained from the fly ash of coal fired thermal power plants their diameters vary from 10 to 300 um, with a typical wall thinckness of about 5-10% of the diameter in figure-[1(a) and (b)].

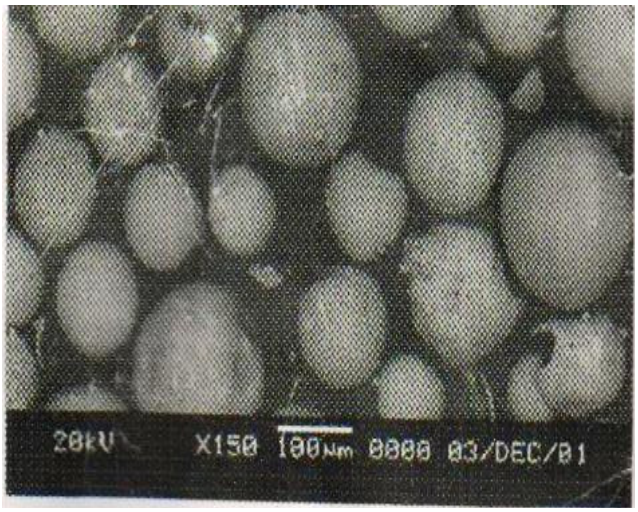

Figure-1(a)
SEM micrograph of the indicating the porous inner/outer surface

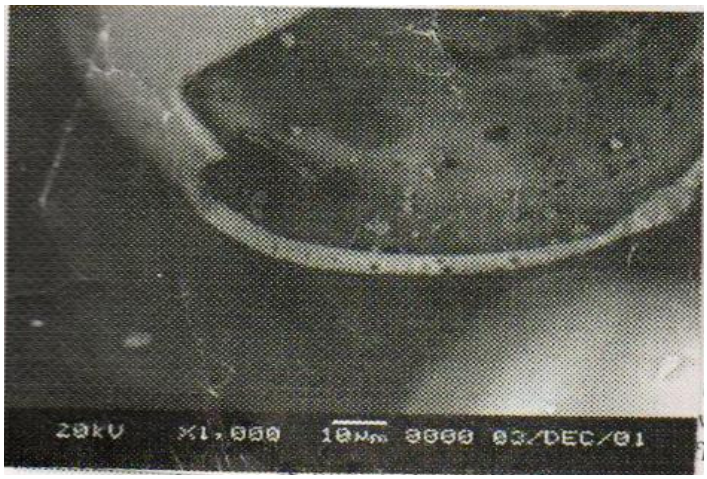

Figure-1(b)
A section of porous and thin walls of a broken cenosphere

Their spherical and hollow morphology, chemical characteristics, as well as their mechanical and energy attenuating properties can be exploited the main advantage presented by cenospheres in comparison with other competitive filling compounds is their low density[1]. In recent years some of the research carried out in the development of processes for making, hallow/masonary, blocks concrete[2-4], Ceramics glass[5-7], wares ceramics[8], silicon carbide, silicon nitrite, β-Cardierite[9], mullite[10] and separation of cenosphere. Silica and Alumina which are the main constituent of fly ash which is used which silica for making solid disc. Low thermal shock and low impact strength caused by quartz (Silica) which is the main constituent of fly ash. At present studied we report results of intake and loss of water, on addition of talc ($Me_3Si_4O_{10}(OH)_2$) belonging to the family of pyrophyllite[11], talc with the mixture of fly ash and naphthalene makes cenosphere solid discs.

Material and Methods

Raw materials and chemicals: The representative sample of fly ash, collected from the five electrostatic precipitators of the thermal power plant at Sarni over a period of two years was prepared by the the method of coning and quatering. The analysis showed that 75% of the powder was below 48 um and the balance 25% was in the particle size range 48 -78 um. Talc mineral lumps were procured from mines located in Jabalpur district of M.P., India[12]. The lumps were crushed manually to small pieces and then powdered in a ball mill of 2.5 kg capacity the fly ash and powdered talc sample were used wholly, without discarding any size fraction. The alkaline phosphatic binder sodium hexa meta phosphate (SHMP), used in the present study was pH laboratory reagent grade.

Preparation of solid disc membrances: The characterstic of fly ash-talc-napthalene mixtures having 0-100% in the presence of 10% sodium hexa meta phosphate have been investigated. The solid disc prepared from the mixtures were dried in an air oven at 110^0C for 2-3hrs and then fried in an electric muffle furnace the heating program used for firing was as follows heating from ambient to 950^0C at a rate of 10/ min holding the temperature for 60, in at 950^0C switching off the furnace to allow furnace cooling of the solid disc to ambient temperature, the temperature of firing (950^0C) was selected as the thermal analysis as shown that due to dehydroxylation of talc, the formation of magnesium delicate with simultaneous reaction with SHMP is completed on heating to 950^0C[13].

Measurement of intake and loss of water in solid discs: The physical parameters of solid disc viz, impact strength, apparent density, % linear shrinkage, and % of intake and loss of water were determined. The procedure for measuring the impact strength of the disc was as followed for pyrophhyllite based ceramic bodies; the apparent density was evaluated by dividing accurately measured mass of the dry solid disc by external volume (dimensional method). The % of intake and loss of water of solid disc was determined using the procedure outlined in the Indian standards specification for this purpose, the disc was dried to constant weight at 110, cooled to room temperature in a desiccator and weighted accurately (W_1). The sample was immersed in distilled water with the help of a cotton twine and boiled water, disc for two hours boiled, the heating was then removed. The disc for 20 hours immersed in water, after that the weighted accurately (W_2) and the % of intake and loss of water calculated by formula.

$[W_2-W_1]/W_2*100$

Results and Discussion

Fired solid disc Impact strength: of fired solid disc: Improvement in the impact strength is due to the increase of SHMP. As we see in figure-2 the graph plot between impact strength and the percentage of talc in the solid. As we the increase in impact strength is increases with the talc content in the mix. disc.

The percentage linear shrinkage and density of disc: The graph plot in figure-3 between the percentage of linear shrinkage and density of disc. We observed that as the talc content in the disc increase the linear shrinkage and density increases.

Weight loss in discs due to sintering: As in the fly ash discs, with increase of talc in the discs the weight loss of disc is also get increased as seen in the graph in the figure-4. The weight loss is due the remove of moisture of the materials and of structural water of SHMP and talc in the discs.

Effect of % of water absorption on addition of talc in the discs: As in figure-5 we see the graph plot between the water absorption percentage and talc percentage in the mixture. We observed that, water absorption increases as the increase of talc in the discs. As porous material (Napthalene) added in the disc of the fly ash-talc. The percentage of water absorption increases gradually.

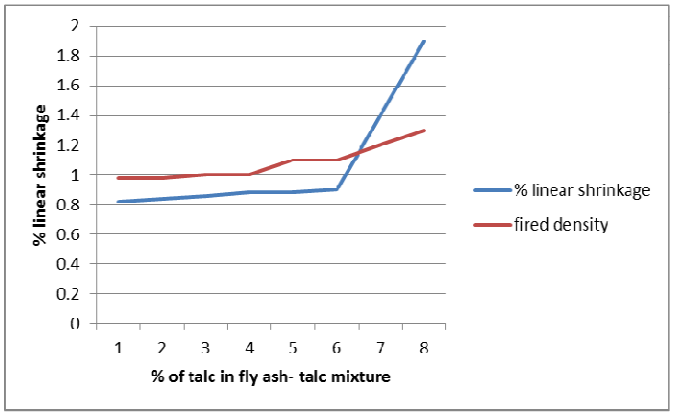

Figure-2
Impact strength in increased as talc increased in mixture

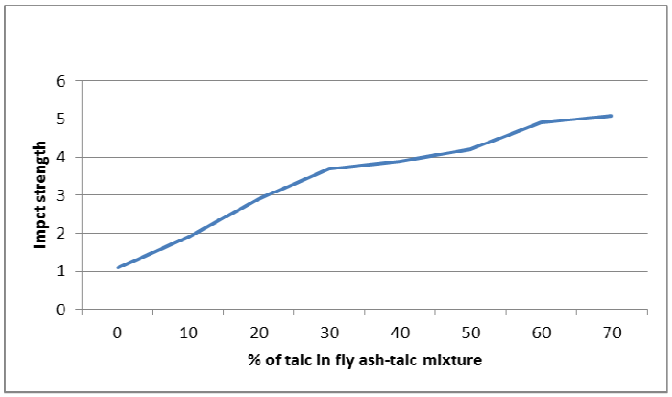

Figure-3
Plot between Density and % of linear shrinkage

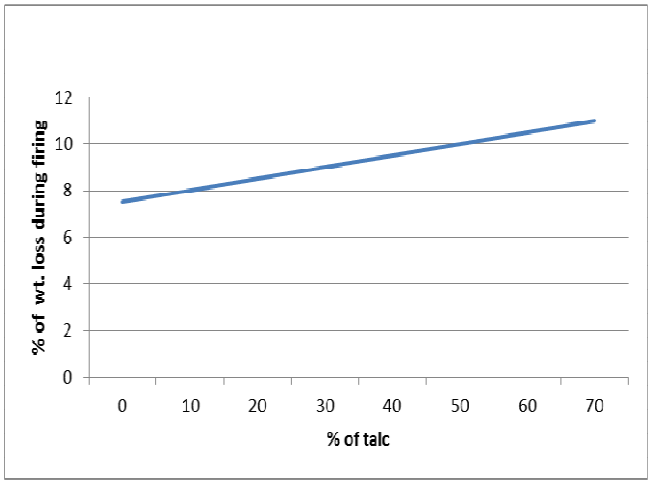

Figure-4
Plot between weight loss increases in content of talc

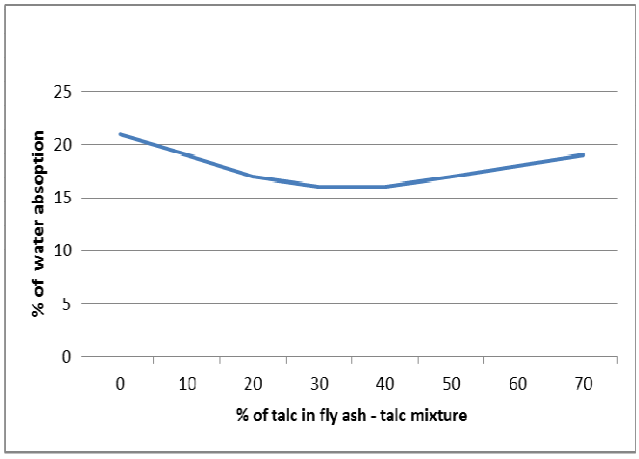

Figure-5
% of water absorption with talc and fly ash mixtures

Conclusion

At last, the result drawn from the present studies are i. The impact strength is improved by increase of talc in the mixture of talc and fly ash while addition SHMP upto 10% at 950^0C for 1 hour. ii. As the content in talc increases the apparent density is also increases. As well as water absorption is also increases. iii. Transportation of metals ions are easily takes place in cenosphere disc if the percentage of water absorption increases as porous material (Napthalene) is added in the mixture of cenosphere disc.

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