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MECHANICAL PROPERTIES OF CONCRETE WITH NANO PARTICLES

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ABSTRACT

Nanoparticles are becoming more popular and are being used in a wide variety of contexts as a means to create materials with desirable qualities. In particular, such particles may enhance the nanostructure of structures.

Materials cement and concrete, to name a few. Concrete technology is interdisciplinary in nature

in the study whereThe advantages that nanotechnology may provide in the opportunity to enhance the characteristics

cast in stone adapting to the particular requirements. It has also been suggested that incorporating nanomaterials into concrete may significantly increase both its strength and durability. Fly ash is used as a partial replacement for Portland cement to lessen the cement industry's carbon footprint. This alternative cement, known as Portland pozzolana cement (PPC), also increases the durability and workability of concrete. There has been an effort to do an experimental study of nano fly ash in concrete. The ball grinding mill was used to finely crush fly ash into nanofly ash. Fly Ash and a trace amount of Nano fly Ash were used to replace 30–40–50% of cement in 20–grade concrete, respectively. Nano fly ash concrete outperformed both conventional fly ash concrete and NCC in terms of strength. Nanofly ash improved the workability of concrete over normal fly ash and NCC.

INTRODUCTION:

New studies have demonstrated that cutting-edge technology allows for increased efficiency and output Cement is an a new dimension to traditional cement technology; likewise, now is the moment to create "NANO TECHNOLOGY" to advance the building industry via the introduction of novel concrete processes and materials. Because of concrete's widespread use in the building sector, efforts have focused on raising the material's standard.

Nanotechnology is the process of creating objects at the molecular or atomic level. Nanotechnology is often connected with the scale of the nanometer (or 109 meter).with study raw stuff in the micro range equivalent to one-billionth of a meter (a Portland cement particles smaller than 500 nm in size are used as the cementing ingredient in nano-concrete. Particle sizes in modern cement may be anything from a few Nano-meters up to roughly 100 micrometers. Micro-cement typically has an average particle size of 5 micro meters.Using a high-energy ball mill, we can reduce the size of the individual fly-ash particles from micro to nano. Ball grinding allows for the alteration of surface characteristics. Fly ash, which is normally smooth, glassy, and inert, may be transformed into a rough and more reactive product with this method.

EXPERIMENTAL PROGRAM:

Concrete cubes serve as the experimental subjects in this study. With a water-cement ratio of 0.5 and a target cube strength of 20 MPa at 28 days, the mix was developed with fly ash replacing some of the grade 53 cement (30%, 40%, and 50%). The use of fly ash in mixes has been simplified by adopting a weight-based replacement ratio (i.e. fly ash for a percentage of cement).

Sixty-three concrete cubes, each measuring 150 mm on a side, will be cast and tested as part of this program of experiments. We've included a rundown of the cubes cast, their identifiers and descriptions, and how long they were allowed to cure.

Cube Id	Fly ash replacement	No of cubes for		
		7 days curing	14 days curing	28 days curing
C	0%	3	3	3
F 1	30%	3	3	3
F 2	40%	3	3	3
F 3	50%	3	3	3

Table I: specimen details of partially replaced fly ash concrete

Cube Id	Fly ash replacement (weight by cement)	Nano fly ash replacement (weight by fly ash)	No of cubes for		
			7 days curing	14 days curing	28 days curing
NF 1	30%	3%	3	3	3
NF 2	40%	3%	3	3	3
NF 3	50%	3%	3	3	3

Table II: specimen details of nano concrete cubes

Results and Discussion:

Workability:

When adding cement alone as a binder the slump value become 85mm.Then while replacing binder about 30% by fly ash the slump value slightly increases. For re placement of binder as 50% by fly ash the slump value

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become 90mm.At the same time adding nano silica to the above mix because of these binary components the slump value slightly increases continuously.

Cube Id	Fly ash replacement (weight by cement)	Nano fly ash replacement (weight by fly ash)	Slump value (mm)	Type of slump
C	0%	-	85	TRUE
F 1	30%	-	87	TRUE
F 2	40%	-	88	TRUE
F 3	50%	-	90	TRUE
NF 1	30%	3%	89	TRUE
NF 2	40%	3%	91	TRUE
NF 3	50%	3%	93	TRUE

Table III: Test result for workability

Standard concrete has a compressive strength of 25.33N/mm2 after 7 days of curing. For concrete with the mix percentage of F1,F2,F3,NF1,NF2,NF3 the compressive strength value at 7 days curing time are less than that of the conventional concrete but 28 days Strength will be greater than the conventional concrete. When compared to the 33.22 N/mm2 achieved by conventional concrete after 28 days, the strength achieved by using Nano Silica at a concentration of 3% and Fly ash at a concentration of 30% is 38.11 N/mm2.

Cube id	Fly ash replacement (weight by cement)	Nano fly ash replacement (weight by fly ash)	Compressive strength (N/mm^2)		
			Curing for 7 days	Curing for 14 days	Curing for 28 days
C	0%	-	25.33	28.88	33.22
F 1	30%	-	21.33	27.11	34.11
F 2	40%	-	13.77	20.44	29.22
F 3	50%	-	10.66	15.11	23.88
NF 1	30%	3%	24.44	29.77	38.11

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NF 2	40%	3%	19.55	24.88	32.33
NF 3	50%	3%	13.77	19.11	27

Table IV : Test result for compression

COMPARISION OF COMPRESSIVE STRENGTH VALUES OF FLY ASH AND NANO FLY ASH CONCRETE CUBES WITH NCC AT 30% REPLACEMENT OF CEMENT

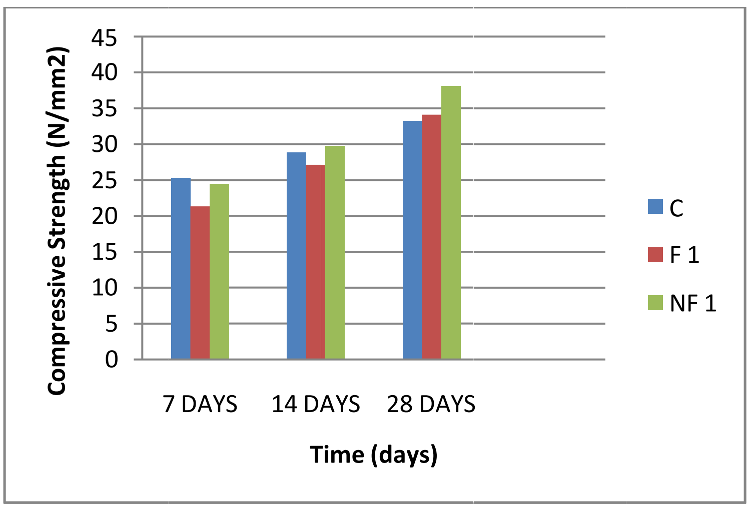

Fig 1: Compressive strength values at 30% replacement of cement

COMPARISION OF COMPRESSIVE STRENGTH VALUES OF FLY ASH AND NANO FLY ASH CONCRETE CUBES WITH NCC AT 40% REPLACEMENT OF CEMENT

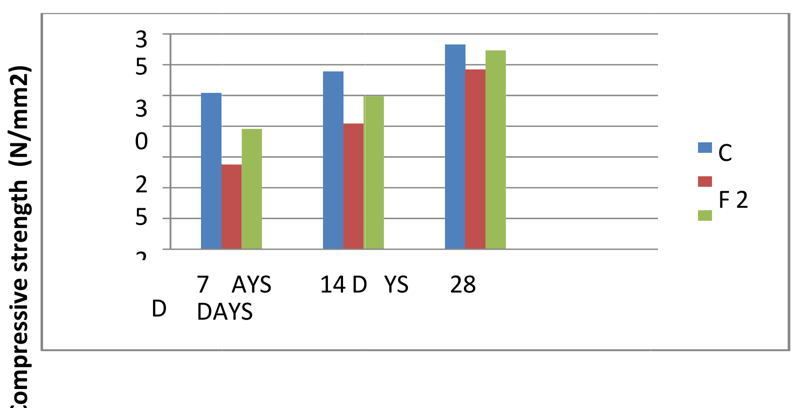

Fig2: Compressive strength values at 40% replacement of cement

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COMPARISION OF COMPRESSIVE STRENGTH VALUES OF FLY ASH AND NANO FLY ASH CONCRETE CUBES WITH NCC AT 50% REPLACEMENT OF CEMENT

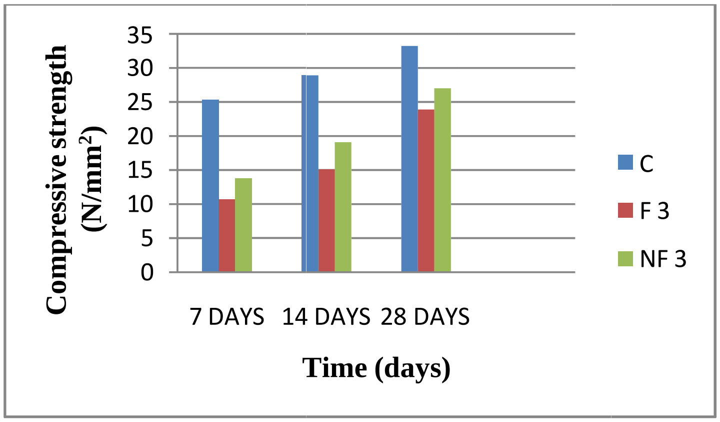

Fig 3:Compressive strength values at 50% replacement of cement

COMPARISION OF COMPRESSIVE STRENGTH VALUES OF NCC, FLY ASH AND NANO FLY ASH CONCRETE CUBES AT 28 DAYS CURING

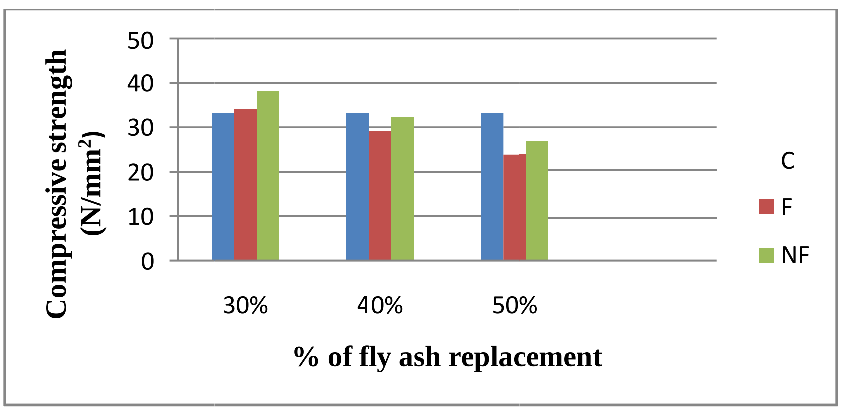

Fig 4: Compressive strength values of fly ash and nano fly ash concrete cubes at 28 days curing

CONCLUSIONS:

The following results are established based on the present inquiry.
Since nano sized particles are the most active, it was found that concrete with nanomaterials had better strength than Normal Cement Concrete.
• Compared to conventional cement concrete, concrete made using nano-sized fly ash is easier to work with.

As the proportion of fly ash in concrete grows, the workability of the material improves. Use of fly ash to improve the mix's workability while decreasing the amount of water needed is proposed.An increase in compressive strength occurs when fly ash content in cement may be reduced by as much as 30 percent. This rate of replacement is optimal, so the argument goes.For 53-grade ordinary Portland cement (OPC), adding more fly ash reduces concrete strength. Due to the pozzolanic activity, the early stage of secondary hydration in fly ash concrete is delayed, hence this is to be expected. Younger age groups are hit worse by the decline than older ones.

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