# Assessment of Impact while using Fly Ash Nano Silica in Concrete Mix for Partial Replacement of Cement

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#### Abstract:

At present, studies on Nanotechnology and Nano materials are emerging and more profound research on nanoparticles like Nano silica, Nano alumina, Nano iron oxide etc., is carried out. In this work, the impact of colloidal form of Nano size particles of silica used in concrete in the modification of the properties of concrete was studied. The concrete strength was improved due to the Nano size particles which filled the voids in between the micron size cement particle by its more specific surface area, and therefore a denser concrete was being achieved. The main aim of this investigation is to explore the influence of colloidal silica on the strength properties of cement mortar. The mortar was made by using Ordinary Portland cement because the Portland Pozzolana Cement contains fly ash i.e. silica content in it.

#### Keywords

Nano materials, Nano silica (nS),

#### 1. Introduction

The construction industries are presenting numerous new and propelled materials for the development of structures. Cement is one of the commodities used in large quantities for the structures, yet increasing the cement production leads to environmental pollution. The essential strategy is to reduce the cement quantity in concrete, to replace cement with other materials having pozzolanic nature such as silica fume or micro silica and Nano silica, thereby reducing pollution of environment. The use of nS and its impact in concrete is not yet completely analyzed. This study intends to display the significance of nS applications in cement concrete and to concentrate on the nS properties to render the appropriateness in concrete. Only very few studies have been carried out on the usage of Nano silica and fly ash in concrete. Many research works were carried out using Nano materials but the works on

combination of fly ash and Nano materials are very less. Nanotechnology is an interesting field of research obtaining huge interest and is being applied in several areas to construct new products which can perform with their physical and chemical properties. The most wide-ranging material in the world Cement Mortar is a nano structural composite material that enhance with time. The totaling of pozzolanic material is a gift for both cement and concrete because there is a unbelievable modification in the effectiveness. Fly ash play an important role in reducing the pollution caused due to cement production. Strength of mortar can be enhanced by adding Nano silica and fly ash by high temperature curing. Analysis made for effective dispersion of Nano particles in concrete mixes states that it will give better mechanical and durable strength resulting in high performance concrete. The performance of concrete with Nano material, silica fumes and fly ash were investigated to obtain compressive strength, concrete chloride diffusivity, sulphate resistance and drying/wetting cycle in corrosive environments. The works of above stated researchers concentrate mainly on improving the concrete strength and thermal insulation and effectiveness of anti-corrosion coatings by nanoparticles. The M20 grade of concrete was prepared using Nano fly ash. Their workability property and compressive strengths were tested. The results revealed that Nano fly ash added concrete is more effective than the conventional concrete.

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#### 2. Experimental Program

Cement conforming to IS 8112:1989, Ordinary Portland cement 43 grade was used as a binding material and sand conforming to IS 383:1970 was used as the fine aggregate in the mix. A water/ binder ratio of 0.5 and a cement content of 380 kg/m3 were used for M30 grade of concrete. The content of fine aggregate 692 kg/m3 and coarse aggregate 1266 kg/m3, respectively were maintained. Specimens were prepared with Ordinary Portland Cement and aggregates with mix proportion of 1:1.82:3.33 was used.

SL.No.	Materials	Specific gravity
1	Cement	3.16
2	Fly ash	2.74
3	Nano silica	1.22
4	Sand	2.60
5	Coarse aggregate	2.80

#### Table1 Specific gravity of materials used

# 3. EXPERIMENTAL RESULTS AND DISCUSSION

Addition of Nano silica in concrete improves the strength by filling the micro pores and making a dense concrete. The combined effect of Nano silica and fly ash in concrete achieves more compressive strength and split tensile strength than conventional concrete. Replacement of cement by fly ash reduces the cost as per economical consideration and reduces the cement quantity in concrete, thereby reducing the cement production and hence reducing the pollution and saving the environment. Compressive strength values obtained from different trials are given in Table.2

Sl.		at 5
No	Description	days
1	Conventional concrete	29.60
2	Concrete with fly ash 30 %	31.60
3	Concrete with fly ash 50 %	29.53
4	Concrete with fly ash 30 % + 1% nS	33.90
5	Concrete with fly ash 50 % + 1% nS	31.95

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## 4. CONCLUSION

Compressive strength of concrete can be achieved by 11%, 24% and 36% more than conventional concrete at 28 days, 56 days and 90 days respectively, when adding 1% of Nano silica in concrete with the addition to 30% of cement replacement by fly ash. It is economical by means of reducing the cost of cement by using fly ash.

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