

# A REVIEW PAPER ON STRENGTH AND DURABILITY ON CONCRETE BY PARTIALLY REPLACEMENT CEMENT WITH NANOMATERIALS

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## ABSTRACT

Concrete is widely and providently used construction material for infrastructures such as buildings, highways and dams etc. This review paper discussed about the nanomaterial used in concrete. Concrete is prepared by ingredients such as cement ( PPC & OPC ) fine aggregate (sand), coarse Aggregate (gravel) and water. The strength and durability two important factor of concrete and this factor depend upon the quantity and quality of material used in concrete design mix. There are many methods to improve the strength of concrete. In such method one of the easy and economically method is to use the nanomaterial in concrete. Nanomaterials enhances the strength of concrete. Use of nanomaterial with concrete in called Nano concrete. PPC or OPC cement generally used in concrete as a binding material because cement is cohesive and adhesive in nature . The size scale of cement particle less than 500nm. The size scale of nanomaterial is less than 100nm. Nanomaterial used in concrete with different varying ratios by partially replacement with cement in concrete.

**Key words:** Concrete, nano materials ,  $TiO_2$ ,  $Al_2O_3$ .

## INTRODUCTION

The day by day increase the demands of concrete for construction high rise buildings and heavy structure etc. required high strength concrete as compare to ordinary concrete. Nanomaterials is much plausible these days in concrete technology. Nanomaterials such as  $TiO_2$ ,  $Al_2O_3$  and  $ZrO_3$ . Use of these nanomaterials in concrete it enhance the strength and durability of concrete by filling micro pores and voids in concrete. Nanomaterials improve the microstructure of concrete helps to formation of C-S-H gel in early age and heat of hydration in concrete.

**LITERATURE REVIEW**

1. **Ali Nazari et al [1]** Studied the partially replacement of cement by nanomaterial  $\text{Al}_2\text{O}_3$  with different ratio such as 0.5%, 1.0%, 1.5% and 2.0% by weight of cement.  
The size was nano particle is 15nm. The researcher prepared two series of concrete mix on is controlled specimen and other is with nano material. It was observed that as the  $\text{Al}_2\text{O}_3$  increase the strength up to 1% partially replacement of cement more than 1% nanomaterial reduction in strength of concrete.
2. **A. H. Shekari and M.S. Razzaghi [2]** Studied the important act of nano materials on physical and mechanical properties of concrete such as compressive strength, indirect tensile strength and durability of concrete were studied through chloride penetration test and water absorption by adding Nano-ZrO<sub>2</sub> (NZ), Nano-Fe<sub>3</sub>O<sub>4</sub> (NF), Nano TiO<sub>2</sub> (NT) and Nano-  $\text{Al}_2\text{O}_3$  (NA) in each specimen was 1.5% of weight of cementitious materials.
3. **Saloma, Amrinsyah Nasution, Iswandi Imran and Mikrajuddin Abdullah. [3]**, In this research paper Nano Fe<sub>2</sub>O<sub>3</sub> &  $\text{Al}_2\text{O}_3$ , Nano TiO<sub>2</sub> (15nm) and Nano silica (10-140 nm) were added up to 2.0 % by weight of cement in concrete. It is derived that the Compressive strength, splitting tensile test and Modulus of elasticity of concrete can be considerable. After 3, 7, and 28 days compressive strength and Splitting tensile strength increases considerably.
4. **Abhishek Singh Kushwaha, Rachit Saxena and Shilpa Pal [4]**, Studied of M30 grade concrete partially replacement with cement by titanium dioxide by weight of cement . The quantity of TiO<sub>2</sub> was varied from 1% to 3% by weight of cement. TiO<sub>2</sub> acts as the Nano particles that fill the Nano-voids in concrete that leads to the increment of compressive strength. The 1% of TiO<sub>2</sub> is optimum for compressive strength of concrete.
5. **Mani. M, Dr. G. Nandini Devi [5]** Nanotechnology is one of most active research areas which have wide application in all construction fields. In this paper, a study is carried out about Nano materials used like nano silica, nanoTiO<sub>2</sub>, and carbon nanotubes which are less than 500 nano meter. Nano silica has heat transfer. Nano Tio<sub>2</sub> also has heat transfer and UV absorption character. By the addition of nano silica, durability and strength performance is increased than conventional concrete.
6. **Deepika Rana et al [6]** Studied the mechanical properties – compressive strength and workability of M20 and M30 grade concrete with partial replacement of cement with Nano Silica (0.5%, 1.0%, 1.5%, 2.0%, 2.5%) and compared with conventional concrete. Slump cone test was conducted to test the workability of concrete. It was seen that the concrete with 0.5% Nano silica yielded maximum workability whereas the concrete with 2.5% Nano Silica showed minimum workability. The workability of conventional concrete as more compared to that of the concrete with Nano Silica. The 7 day and 28 day compressive strength of concrete corresponding to 0.5% Nano silica was reduced as compared to the conventional concrete. The values of strength started increasing for concrete with 1%, 1.5% and 2% Nano silica and further decreased for concrete with 2.5% Nano silica. It was concluded that workability of concrete decreases by increasing the amount of Nano silica and 2% silica dosage was concluded to be the ideal dosage for partial replacement of cement in concrete.

7. **Arti S. Pharande, Dr. Geetha K. Jayaraj and Sanjeev Raje,[7]** Concrete is the most consumed material in construction field. Therefore, continuous research is conducted to enhance the properties of concrete. Nanotechnology refers to the study of structures between 1 Nanometer (nm) and 100 Nanometers in size. It is also broadly used in various fields of biomedical, robotics, electronics. Incorporating Nanotechnology in concrete to enhance its properties is one of the most dynamic research areas today. This paper discuss and reviews the studies performed so far on Nanotechnology in concrete by the use of Nano materials like Nano silica, Nano TiO<sub>2</sub>, Nano Al<sub>2</sub>O<sub>3</sub>, Nano Fe<sub>2</sub>O<sub>3</sub>, Nano ZrO<sub>2</sub> in concrete as a partial replacement of cement. The impact of Nano materials on the properties of concrete is studied. Various Nano materials that are used in concrete are briefly explained and the comparison of their effect on concrete is discussed in this paper. This review work will help in better understanding of application of Nanotechnology in concrete.

## CONCLUSION

- Nano materials used in concrete partially replaced by cement by weight.
- After all observations it was concluded that partially replacement of cement up to 1% of cement shows increment in strength.
- Increase the content of nono materials reduces workability of concrete.

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