

ADVANCEMENT OF CIVIL CONSTRUCTION WITH NANOTECHNOLOGY

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ABSTRACT:- Nanotechnology has the potential to revolutionize the civil construction towards more innovative infrastructure and at lower cost and maintenance with longer durability are deliberated and widen the vision of civil engineering. Nanotechnology can be used for self-sensing, self-structural health monitoring and self-healing during the structure life. It is capable of providing an advance indication of the structural condition before a failure of the structure can occur. This paper explores a broad overview of the potential application of nanotechnology in constructing structure and its future prospect.

KEYWORDS:- Nanotechnology, Nano particles.

INTRODUCTION:-

Nanotechnology is a technology in which the matter is controlled at the atomic level to create a new large scale of materials. Basically Nano, is a greek word which indicates a billionth. It is an extension phase of science and technology with the ultimate use of physics and chemistry. It was introduced by American physicist Richards P. Feynman in 1959.

In civil construction Nanotechnology plays a vital role to create new technologies. Nanotechnology can be use for design and construction purpose by the use of many unique charateristics. The role of nanotechnology in innovative infrastructure system has the potential to transform civil construction. Use of nanotechnology understand the evolution in the hydration of cement with the use of nano particals like nano silica, titanium dioxide and carbon nano tube, so it will be more durable, stronger and easily placed. The main motive behind the nano

technology in construction is to make the construction field at the next level of advancement.

This paper is the comparison analysis of different writer's research papers on the topic of nanotechnology in construction. After analyzing other theories and some new concept regarding it, this paper have been reviewed.

Application of Nanotechnology in Civil Construction:-

1. Nanotechnology and Concrete.

Nano Particles

Application and Effect

(a.) Nano Silica(SiO_2)

SiO_2 addition cement based material

can control the degradation of calciumsilicatehydrate(C-S-H) reaction caused by calcium leaching in water as well as block water penetration which lead to increase in durability.

(b.) Titanium Dioxide(TiO_2)

It is used in cement, paints, glazing tiles and windows for its antibacterial effects as well as being hydrophilic. It is used as self cleaning properties of structure's surface.

Due to being hydrophilic, it gives self cleaning properties to applied surface.

(c.) Carbon Nanotubes(CNTs)

Additions of CNTs in concrete, improves crack resistance, enhanced mechanical properties and structural health monitoring capacity.

- (d.) Zinc oxide nanoparticles (ZnO) Addition of ZnO in concrete, improve the resistance against water.
- (e.) Aluminum oxide nanoparticles (Al₂O₃) It increases the tensile and flexural strength.

2. Nanotechnology and Steel.

Nano Particles

Application and Effect

- (a.) Copper Nanoparticle It limit the number of stress riser and finally control fatigue crack by reducing the rough surface of steel.
- (b.) Vanadium and Molybdenum nanoparticle This nanoparticle use in high strength bolts to improve the delayed fracture problem as well as also reduce the effect of hydrogen Embrittlement.
- (c.) Magnesium and calcium nanoparticle These nanoparticle is used to increase in weld toughness.

3. Nanotechnology for Glass

Nano Particles

Application and Effect

(a.) Titanium Dioxide(TiO_2)

Being hydrophilic in nature it can be used in antifogging coating and in self cleaning.

(b.) Nano Silica(SiO_2)

It is used in making of fire protective glass. This is obtained by using fumed Silica(SiO_2) nanoparticle.

4. Nanotechnology and Coating

Nano Particles

Application and Effect

(a.) Titanium Dioxide(TiO_2)

The main application of TiO_2 in paint is to make the metal corrosion free. Being hydrophilic in nature, it reduces seepage problem.

5. Nanotechnology and Fire Protection

Nano Particles

Application and Effect

(a.) Nano cement

It can make the structure tough, durable, high temperature coating. This can be done by mixing of CNTs with the cementitious material to fabricate fibre composites that can give some outstanding properties of nano particles.

6. Nanotechnology and Structural Monitoring

Nano Particles

Application and Effect

(a.) Nano-Micro-Electromechanical

Sensor (NMEMS)

It is ingrafted into the structure during the construction to control and monitor the material and structure performance. (eg: temperature, stress, strain, smoke, vibration, crack, corrosion etc.)

CONCLUSION:-

In this paper we have discussed about the nanotechnology and nanoparticle. It is the newest topic to be research in the field of construction.

It has not fully developed yet but when it will be develop then it will become life saver. Because nanotechnology and nanoparticle have tendency to monitor the ultimate strength of construction material and heal it before destruction.

The main motive behind this review paper is to aware the people about the nanotechnology and its implementation.

Nanoparticle like NMEMS, Nanocement, Nanosiloca etc play vital role in leading the city towards smart city.

On further, nanoparticle like hydrophobic coating on metal is also a great achievement in construction, because it reduces the problem of seepage fully, in this way building can be protected from dampness.

In other words we can say that this paper have been reviewed with a plan that how civil engineering can take advantage by implementation of nanotehnology and nanoparticle.

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