Nanotech Made It Easy

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Abstract

One of the major issues to be addressed when coming to construction is the choice of the appropriate material. An already, classical implementation of the field techniques, widely used for construction is Cement, Steel, Glass, Wood etc. are the main components of any construction now a days. In recent years, several emerging high strength materials have attracted enormous attention as potential candidates for construction. High strength steels has been used as main part of building for more than 40 years because of its manufacturability and ability to deliver continued tensile improvements as it has been made ever stronger. Being a good and responsible citizen of India we here are presenting the paper that tries to solve the problems of the Indian Army with the best of the technologies that we have so that they can have the good condition for the work and as they ensure our protection we can ensure that they are more safer while protecting us. We here have compared the tradition base camps and the condition of the work and tried to solve their problems with the use of Nanotechnology. The unique properties of nanomaterial's have provide its beneficial use in various fields and have considerably grown to a large scale in field of defense for Developed nations. Here the nanotech concepts we have used to modify the tradition methods of national security and give sustainability to the defense industries. Although these materials have unique properties along with that few considerations like cost and economy is to be made.
Keyword- Nanotechnology, SCC, INTERFLAM

I. INTRODUCTION

Nanotechnology is not a new science and it is not a new technology, nanotechnology is a combination of science, engineering and technology. Nanotechnology is the study of very small pieces of materials by themselves or their manipulation to create new large scale material. It is the re-engineering of materials by controlling their shape and size at the nano-scale. The key of nanotechnology is the size of particles because at the nano-scale, the physical, chemical, and biological properties of materials are unique and improved from the properties of individual atoms and molecules or bulk matter. These properties are improved due to increase in relative surface area and new quantum effects.

At the nano-scale materials properties are altered from that larger scale. The nano-scale is the size range from approximately 1nm to 100nm. These are some nano-particles which occur naturally, but most practically used are synthetic materials. synthetic nano-materials having common type such as nano-tubes, quantum dots, nano-wires, nano-rods.

II. NANOTECHNOLOGY IN CONSTRUCTION

Nanotechnology based products can improve the current construction materials. Nanotechnology in construction mainly focused on concrete having better properties using different nano-materials, fire–protective and self–cleaning glass, and steel having better physical properties, high thermal insulation material and nano – sensors for construction. The different applications of nanotechnology in construction are as follows:

A. Nano Concrete

Concrete is macro – material strongly influenced by its nano – properties. The mechanical behavior of concrete material depends on the phenomenon that occurs on a micro and nano-scale. The addition of nano-material into concrete could improve its properties. Nano – Sio_2 could significantly increase the compressive strength of concrete by providing large surface area for pozzolonic reaction as compared to silica fume and also act as filler to improve microstructure. Nano – Sio_2 could effectively absorb the calcium hydroxide crystals and increase the concentration of calcium silicate hydrate in concrete. The higher concentration of calcium silicate hydrates provides dense and strong concrete. The utilization of nano-fly ash into concrete gives higher workability as compared to normal concrete. The scanning electron microscopy (SEM) of normal and nano fly ash as shown in fig.

The use of nano Al_2O_3 as partial replacement of cement up to 2% in blended concrete provides higher compressive strength compared to that of concrete without nano Al_2O_3 particles. Another nano-material's which is carbon nano-tubes, which when added in small amount in concrete provides better mechanical properties. The carbon nano-tubes having two types – single wall carbon nano-tubes and multi wall – carbon nano-tubes are shown in fig. It is found that addition of 0.045% of multi wall carbon nano-tubes into concrete can increase its spilt tensile strength by 66.3%.

Self-compacting concrete (SCC) is concrete which flow its self-due to its own weight. CuO nano-particles as partial replacement of cement up to 4% improves the compressive strength of self – compacting concrete and reverses the negative effects of super plasticizers on compressive strength of the specimens. CuO nano-particles accelerate c-s-h gel formation as a result of the increased crystalline $Ca(OH)_2$ amount at the early ages of hydration. ZnO nano-particles improve the pore structure of self – compacted concrete and increase its mechanical strength.

B. Nano Steel

Steel is a major part of the construction industry and nanotechnology helps to improve its properties, such as strength, corrosion resistance, and weld ability. The bridges or towers, whenever subjected to cyclic loading can lead to failure due to fatigue. Stress risers are responsible for fatigue failure. The use of copper nano-materials can reduce the stress by providing better surface evenness. The high strength bolt having common problem is delayed fracture, which can be reduced by using vanadium and molybdenum nano-particles. These nano particles reduce the embrittlement of grain boundaries in steel by small amounts of hydrogen and also improve the steel micro – structure. The addition of small amount of magnesium and calcium nano-particles into steel matrix can improve the weld toughness.

There are many companies worldwide, such as Sandvik, Arcelor Mittal, JFF steel, Nippon steel's, Nanosteel and Metallium which develop steel based on nanotechnology.

C. Nano-Glass

Nanotechnology in glass is focusing on fire – protective, heat resistive, self – cleaning and reflective glass. Mostly glass in construction is used on exterior of building which is directly exposed to sun light. It is difficult to control the light and heat entering through building glaze, which is reduces the efficiency of air – conditioning systems. The glass sheets with a laminated polymer film containing solar heat adsorbing nano-particles, could selectively filter – out certain ranges of unwanted infrared light that otherwise would cause the interior of the building to heat up.

Self- cleaning glass can be produced by Tio_2 nano-particles. These nano-particles decomposed the organic pollutants, volatile organic compounds and bacterial membranes by photo-catalytic reactions as shown in fig. due to the hydrophilic nature of Tio_2 nano-particles, their attraction to water from drops, which then washes off the dirt particles that are decomposed by photo-catalytic reactions. Fire- protective glass can also obtained using thin, transparent metal oxide coatings on glass, which simply works by reflecting heat radiation. Another fire protective glass can be obtained using fume silica nano-particles. In this clear interlayer made of silica fume is incorporated in between two glass panels which react to form a rigid and opaque fire shield when heated. In this technique, INTERFLAM and INTERFIRE are fire- protective glass. The nonporous coating of Sio_2 on glass reduces the reflectivity of glass and provides the anti-reflection glass for a architectural applications.

D. Nano-Sensors

Nano and micro electrical mechanical systems sensors have been developed and used in construction to monitor and/or control to environment conditions, materials and structure performance. One advantage of this sensor is their dimensions, 10- 9m to 10- 5m. smart aggregate, a low cost piezo – ceramic based multi –functional device has been applied to monitor early age concrete properties such as moisture, temperature, relative humidity and early age strength development. The smart aggregate also be used for structure health monitoring.

The disclosed system can monitor internal stresses, cracks and other physical forces in the structures during the structure life.

III. BORDER CONDITIONS IN INDIA

Fig. 1:

Fig. 2:

Fig. 3:

E. The New Design Will Give Many Benefits and That Are Compared Below

Considerations	*Traditional*	*Nanotechnology*
Economy	*Low*	*Moderate/High*
Strength	*Low*	*High*
Life	*Less*	*More*
Operation	*Not Safe*	*Safe*
Maintenance	*Easy*	*Easy*
Feasibility	*No*	*Yes*
Method	*No Expert*	*Experts Needed*
Equipment's	*No*	*Yes*
Availability	*Yes*	*Not Much*
Security	*Low*	*High*

IV. CONCLUSION

Research in nanotechnology that is related to construction is still in its infancy; however, this paper has demonstrated the main benefits and barriers that allow the effect of nanotechnology on construction to be defined. Recent years of R&D have shown massive investments Nano-construction. The activities in Nano related products for the construction industry are not well marketed and are difficult for industry experts to identify. A large-scale and visible initiative from nano-science and nanotechnology in the construction area could help seed construction related nano-technological development. Focused research into the timeous and directed research into nanotechnology for construction infrastructure should be pursued to ensure that the potential benefits of this technology can be harnessed to provide longer life and more economical infrastructure. This paper concludes with a roadmap and strategic action plan on how nanotechnology can have its biggest impact on the field of civil engineering.

The innovation of relevant nanotechnology and its significance in civil engineering practice is illustrated in this paper for broadening vision. Nanotechnology deals with understanding, controlling and manipulating matter at the level of individual atoms and molecules in the range of 0.1–100 nm (10-9 m). It creates materials, devices, and systems with new properties and functions. The role of nanotechnology in the conceiving of innovative infrastructure systems has the potential to revolutionize the civil engineering practice and widen the vision of civil engineering. Following this the analysis were carried out in ductile structural composites along with its enhanced properties, low maintenance coatings, better properties of cementitious materials, reducing the thermal transfer rate of fire retardant and insulation, various nanosensors, smart materials, intelligent structure technology etc. The properties like self-sensing, self-rehabilitation, self-cleaning, self-vibration damping, self-structural health monitoring and self-healing are the key features.

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