

A Review of Nanotechnology in Civil Engineering

Mohammed Noori Hussein Alhashimi*

Iraq University College, Iraq, Basra

Review Article

Corresponding authorMohammed Noori**Hussein Alhashimi***Article History***Received: 12.08.2018**Accepted: 25.08.2018**Published: 30.08.2018***DOI:**

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Abstract: The term nanotechnology is one of the newest scientific terms being searched for in various fields of science, especially in the fields of engineering. Nanotechnology has been widely used in all fields of engineering, especially in the field of civil engineering where nanotechnology has been able to develop and improve significantly the characteristics of construction materials used in the field of construction. This review paper will focus on the importance of nanotechnology and its impact in the various fields of civil engineering and its impact on Construction materials.

Keywords: Nanotechnology, Nanomaterials, Construction materials.

INTRODUCTION

The term nanotechnology has become very common at present and may enter into all things of life and as an engineering definition of this insulator; the nanotechnology is the engineering science that deals with nanoparticles, which is about 100 nm or less than 100 nm. Nanotechnology has become very important in recent years for entry into all areas of life, especially in the industrial fields where nanoparticles have spread very widely. Studies indicate that sales of these materials will reach 3000 billion by the year 2020 [1]. A wide extent of challenges gone up against by the improvement business, stretching out from the execution of the materials to wellbeing and ecological issues, relate to materials and their properties. Late progressions and advancements in various areas of nanotechnology demonstrate important assurance in tending to these troubles [2]. In this study we will discuss the importance of Nano in the fields of civil engineering and how to use nanotechnology in various construction materials in addition to studying the materials that will be acquired by the construction materials that enter the Nano in its composition and the advantage of nanotechnology in field of construction.

Keeping in mind the end goal to have the capacity to use in the development business the nanomaterials at wide scale it is essential that the inquiries about to be led following the following stages: the decision of nanomaterials with potential use in development and the investigation of their attributes; the conduct investigation of the building components that contain nanomaterials under different burdens; the advancement of particular outline and development guidelines.

The Future of Civil Engineering with Nanotechnology **Effect of nanoparticles on properties of structural materials**

Based on the previous studies that were looking at the use of nanotechnology in the construction materials within the field of civil engineering found that nanotechnology has contributed effectively in the production of construction materials with a very high durability and specifications compared to ordinary materials, for example, concrete is a basic construction materials used in the construction and when using nanotechnology in the production of concrete we will

get the concrete with high compressive strength and durability as a result of nanoparticles that block the pores in the concrete to less absorption and the entry of water into it, leading to the production of high compressive concrete compared to the concrete obtained from ordinary materials [3]. The utilization of nanomaterials in the piece of a few materials, for example, bond, will result in critical decreases of CO₂ contamination and the utilization of execution warm protections will result in effective utilization of vitality for ventilating. Additionally, nanomaterials connected to the surfaces of basic components of the building can add to natural cleaning by photocatalytic responses [4].

Concrete

Concrete is a commonly used material in construction. The concrete is made up mainly of cement. Nanoparticles can be used in concrete as pozzolanic materials like fly ash or silica fume powders. These small nanoparticles will give a larger surface area to the concrete that will reduce the workability of the concrete as well as give the concrete durability and high compressive strength as well as improve the mechanical properties of the concrete [5].

Coatings

The coatings consolidate certain Nano particles or Nano layers have been produced for certain reason including: defensive or against consumption coatings for segments; self-cleaning, warm control, vitality sparing, hostile to reflection coatings for glass/windows; simple to-perfect, antibacterial coatings for work surfaces; and more solid paints and hostile to spray painting covering for structures and structures. For instance: Self-cleaning windows have been created and advertised by Pilkington, St. Gobain Co., and others [5]. Extraordinary coatings can likewise make the connected surface both hydrophobic and oleo phobic in the meantime. These could be utilized for hostile to spray painting surfaces, floor coverings and defensive attire and so forth. Scientists in Mexico has effectively built up another kind of against spray painting paint DELETUM, by functionalising nanoparticles and polymers to frame a covering repellent to water and oil in the meantime [6].

Steel

In steel, weakness is a noteworthy issue that can prompt the auxiliary disappointment when steel is subjected to cyclic stacking, for example, in spans or in towers. This can occur at stresses fundamentally lower than the yield worry of the material and prompt a noteworthy shortening of valuable existence of the structure. Stress risers are in charge of starting breaks from which weariness disappointment results and research has appeared that the expansion of copper nanoparticles lessens the surface unevenness of steel which at that point restricts the quantity of stress risers and consequently exhaustion cracking. When the rigidity of tempered marten site steel surpasses 1,200 MPa at that point even a little measure of hydrogen embrittles the grain limits and the steel material may come up short amid utilize. This wonder, which is known as deferred crack, has obstructed the further fortifying of steel jolts and their most noteworthy quality is constrained to something close to 1,000 to 1,200 MPa. Research take a shot at vanadium and molybdenum nanoparticles has demonstrated that they enhance the postponed break issues related with high quality jolts. This is the consequence of the nanoparticles decreasing the impacts of hydrogen embrittlement and enhancing the steel microstructure through lessening the impacts of the between granular cementite stage [7].

Effect of Nanotechnology on construction

Nanotechnology has widely been connected in development materials with novel functionalities and enhanced qualities. The use of nanomaterials can be found in numerous materials, including bond, solid, covering, paint, glass, and so on. In concrete, nano/microsilica has been broadly examined and connected. Enhanced exhibitions, for example,

mechanical properties, strength and flexibility are accounted for, and diminishment of vitality utilization has been asserted due to the lessened bond measurement and because of the enhanced protection when connected as façade materials. As of late, incredible consideration has been paid to air quality, including both inside and outside. Utilization of nanotechnology for this reason, for illustration, photocatalytic oxidation (PCO) strategy, has been tended to by various considers. This is reflected in the many distributed articles in the most recent decade. A semiconductor (eg, TiO₂) can be connected in the grid of development materials like cement or on the surface of the development materials in an arrangement of covering. Air poisons, including both natural (eg, unstable natural mixes (VOCs) like toluene) and inorganic (eg, NO_x and SO_x), can be expelled by photo catalysis. Moreover, microorganisms and particles can likewise be debased by PCO. Moreover, the photograph instigated super hydrophilic property of TiO₂ brings an additional measurement of this innovation, to be specific, a self-cleaning property. An effective case is a TiO₂ surface-changed glass window, which has an antifogging property due to the light-interceded surface hydroxylation. Another case of nanomaterials in development materials is carbon-based nanomaterials. Carbon nanotubes as an intermediary for polymeric synthetic admixtures can surprisingly enhance certain properties, for example, toughness by sticking cement fixings. Nano sensors are likewise executed in development structure for different purposes, among which one essential application is wellbeing checking (can be remotely controlled and ongoing checked). Another case is the amalgamation and application of Nano silica in development materials. Nano silica particles can alter light ingestion/reflection, imperviousness to fire, solidness, and mechanical properties of the embedded materials. It can be fundamentally presumed that numerous changes have been accomplished due to use of nanotechnology. By and by, it can likewise be watched that contrasted with the headway of nanotechnology and nanomaterials in different fields, the development area has been generally moderate in making up for lost time with the transformation of nanotechnology. Purposes behind this may incorporate: (1) the absence of major comprehension of the compound and physical instruments and structure of nanomaterials at the nan orange, without which any endeavoured adjustments at this length scale will just be experimentally based; (2) absence of understanding on what adjustments nanomaterials will convey to development materials, particularly extremely complex materials like cement. Thus, a promising yet at the same time long route is before us to delve into the progression of nanotechnology in development materials [8].

Effect of Nanotechnology on environment

The impact of different Nano-materials on regular habitat is fervently in nanotechnology and natural inquiries about. Different continuous examinations have focused on the vulnerability in regards to the potential impacts of materials that exist on Nano-scale with properties that are not the same as when utilizing the material on a small scale or full scale. Some work in such manner demonstrates that the potential impacts might be negligible. As developed framework is given in regular habitat, all materials utilized in the development and upkeep of these offices should be good to the common habitat and their consequences for indigenous habitat ought not to be negative. Common potential issues in such manner incorporate filtering of materials into groundwater, discharging materials into aviation routes through the age of residue, and uncovering possibly unsafe materials amid development and upkeep activities. The nanotechnology turns into a twofold edged sword to the development business. More looks into and rehearse endeavours are required with brilliant plan what's more, arranging with the goal that development tasks can be made feasible, and in this way, spare vitality, decrease asset use, and maintain a strategic distance from harms to the earth [9-11].

The cost of nanomaterials used in construction

It is noted that the cost of using construction materials produced according to nanotechnology is very high because of the high technology required to establish such materials in addition to the expertise and scientific skills necessary [11]. For example, if we compare between the cost of one cubic meter of ordinary concrete made of ordinary cement and one cubic meter of high strength concrete made of Nano silica and cement, will see the cost of producing the ordinary concrete is half the cost of producing high-strength concrete. Regardless of the high cost of Nano materials, they are much better than the refractory methods used to improve building materials or structural components.

CONCLUSION

Based on the findings of this review paper, we will conclude that nanotechnology will be the most promising prospect for construction materials, which will give very good properties, which will improve the performance of concrete structures. Nanotechnology is still evolving and over time will give more advanced results in civil engineering.

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