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Nano Technology in Architecture: Exploring Possibilities.

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Abstract: *The nano science and nano-engineering is also referred as nano modification, have come into common usage and describe two main avenues of application of nanotechnology in architectural application. Even though a huge and alluring potential of nanotechnology in architecture and civil engineering has been envisaged and enormous efforts throughout the world are being taken unto use nanotechnology in architectural applications, still few of grey areas need to be explored to make the technology more applicable. This paper presents the developments in the field of nanotechnology and nano science research in architectural development.*
Keywords: *Nano, architecture, concrete, composites, materials.*

I. Introduction

Nano bio building structure and nano materials are likely to bring significant changes in architecture and building technology .These new materials present new opportunities to solve problems like heat absorbing windows, energy coatings etc. Smart buildings concerning biodegradable features and nano-bio-building facilities are innovative practices in building industry. It calls for making designers capable of adopting new innovations of architecture as nano materials during design process. In architecture and the construction industry nono technology is capable of leading the building structure and architecture to an optimum level.

There are many innovative nano materials like the coating of surfaces to render them functional characteristics such as increased tensile strength, self-cleaning capacity, fire resistance, and many other capacities. The future of the nanotechnology field depends on architects and planners ability to assemble nanoparticles into 3D structures we can use to develop new technologies.

Nanomaterials are not only useful for some partial application such as roofs and facades; they also expand some design possibilities for interior and exterior spaces. Nano-insulating materials open up new possibilities for sustainable design strategies. It is projected that Nanotechnology will take building envelop materials (coatings, panels and insulation) to a maximum capacity of performance in terms of energy, light, security and intelligence. Even these first steps into the world of nanotechnology could significantly improve the nature of building structure and efficiency and the way modern buildings relate to environment. The development of carbon nano tubes and other breakthrough materials could affect building design and performance.

II. Properties of Nano Materials

New materials are being created on a microscopic scale that potentially improves buildings and architectural development as a whole. . They include metals, ceramics, polymers or composites. Known as nano materials, nano composites, and manufactured nano materials (MNMs), the method of making these materials begins at the molecular or atomic level, creating new products with extraordinary physical and chemical properties.

They enhance strength of materials as well as have properties like self-cleaning, super hardness, electrical conductivity, antimicrobial superior thermal resistance and stability, non-flammability, lightweight, anti-corrosion, superior barrier, light emitting and low permeability, among others. Their applications in architectural development and building industry include use as fire retardants, high performance insulation, protective coatings, equipment lubricants, structural integrity enhancement and monitoring, photovoltaic, stronger tensile cables, and self-cleaning or heat absorbing windows.

III. Nano Materials For Architectural Application

Use of nano-materials in architecture result in improving building structure and efficiency, and could even change buildings' design and performance. Considerations of the lifecycle of nano materials are important in determining the impacts on the health of building inhabitants and construction workers, as well as the environmental effects at all stages of manufacturing, construction, operation, demolition, and disposal .Nanotechnologies allow today many applications for the architectural sector in terms of innovative products for the treatment of surfaces and smart materials for building construction. Nano materials have varied applications in architecture some of which are discussed in the following section.

IV. Nano-Materials For Architecture And Preservation of Cultural Heritage

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In the recent years, applications of nanotechnology for the conservation and restoration of architectural and cultural heritage have emerged, which put a challenge for the traditional methods. These innovative technologies appear as groundbreaking and promising tools, able to improve the procedures for intervention, overcoming the major deficiencies that characterize some of the traditional techniques currently used, also allowing a more reliable and sustainable preservation of architectural and cultural heritage .

For preservation of artefacts the use of substances aimed at the consolidation of mural paintings and stone surfaces, such as those using CaOH, showing high compatibility with historical aspects. Nano structured cleaning systems for the removal of polymeric coatings previously applied and high retention gels for treatments with organic solvents.

The main advantages of using nano structured products in architecture and cultural heritage preservation fields is valuable in terms of greater reliability over time and sustainability, being non-toxic and environmentally friendly treatments, also considering the reduction of the environmental footprint of the built environment throughout the efficient use of resources.

V. Nano Materials For Structural Aspects

Nano-concrete made with Portland cement in which particle sizes ranging from a few nanometer to a maximum of about 100 micrometers and in Nano ingredients with at least one dimension of nano meter size. The particle size has to be reduced in order to obtain nano- Portland cement. Further, if these nano-cement particles are processed with nanotubes and reactive nano-size silica particles, then strong, tough, more flexible, cement can be developed with enhanced properties.

Self Healing Concrete:

Self-healing concrete is another promising material when it cracks, embedded microcapsules rupture and release a healing agent into the damaged region through capillary action. The released healing agent contacts an embedded catalyst, polymerizing to bond the crack face closed. In fracture tests, self-healed composites recovered as much as 75 percent of their original strength. They could increase the life of structural components by as much as two or three times. When cracks form in this self-healing concrete, they rupture microcapsules, releasing a healing agent which then contacts a catalyst; triggering polymerization that bonds the crack closed.

Self-cleaning: Photo catalysis

Photo-catalytic self-cleaning is probably the most widely used nano-function in building construction. These materials provide self-cleaning, easy-to-clean, anti-graffiti, and anti-bacterial properties. There are numerous buildings around the world that make use of Photo-catalytic self-cleaning which greatly reduces the extent of dirt adhesion on surfaces. Fine Coat, TiO_2 photo-catalytic self-cleaning membrane, is used in the Narita International Airport of Tokyo, Chiba,Japan, with an area of 6,250 m².

Fig.1. Narita International Airport of Tokyo, Chiba,Japan

Nano technology is used for air-purifying properties of nonmaterial which are beneficial to play an important role both for indoor as well as for outdoor environments. It has been used in the Jubilee Church (La Chiesa del Dio Padre Misericordioso), conceived as part of Pope John Paul II's millennium initiative to rejuvenate parish life within Italy, is located outside central Rome. In this three giant sails reaching up to 36m made out of prefabricated high-density concrete with white color which is achieved by adding Carrara marble and titanium dioxide to the mixture.

The photo catalytic self-cleaning additive enables the preservation of white color in an urban environment that is heavily polluted by traffic generated pollution to a great extent. It renders the building not only remains clean, the large surface area of the sails also helps combat pollution by reducing the amount of volatile organic compounds and nitrogen oxide in the air considerably.

Fig.2. Chiesa di Dio Padre Misericordioso Rome.
.Source:www.bezsmogu.cz

Fire-proofing

Nano fire safety glass is developed with a thickness of only 3 mm of a functional fill material between glass panes which provide more than 120 minutes of fire resistance against constant exposure to flames of a temperature of over 1000°C. For this particles of between 4 and 20 millimicrometres" referred as Aerosil which is a pyrogenic silicic acid, is produced and used for a number of purposes including in the paint industry.

The pyrogenic silicic nano-particles, or nanosilica, are only 7 nm large and due to their relatively large surface area highly reactive. Depending on the desired duration of fire-resistance, the highly effective fill material is sandwiched between one or more panes of glass. The size of the fill particles can be modified and is given in terms of its surface area in square meters per gram. Standard products are generally between 90 and 380 m^2per gram. The main advantages are the comparatively light weight of the glass, the slender construction and accompanying optical appearance as well as the long duration of fire-resistance. Currently it is installed in Dubai's newly constructed Dubai International Airport.

Fig,3, Dubai International Airport.
Source: en.academic.ru

VI. Conclusion

Nano Architecture can make a concrete contribution to optimization of existing products, damage protection, reduction in weight and / or volume, reduction in the number of production stages. It results in a more efficient use of materials where there is reduced need for maintenance (easy to clean, longer cleaning intervals) and / or operational upkeep. The use of nano material and technology result in reduction in the consumption of raw materials and energy and reduced CO2 emissions that will affect good in environment, conservation of resources which contribute for greater economy as well as human comfort

References

[1]. MichaelF. Ashby, Paulo J. Ferreira, Daniel L. Schodek, "Nanomaterials, Nanotechnologies and Design: An Introduction for Engineers and Architects" Elsevier Ltd. 2009.
[2]. Ritter, Axel. Birkhäuser "Smart Materials in architecture, interior architecture and design"., Berlin, 2007.
[3]. Nanomaterialhttp://www.gitam.edu/eresource/nano/nanotechnology/nano_materials.htm
[4]. Nanomaterials for Today (Narita-International-Airport-Corporation) http://es.cyclopaedia.net/wiki/Narita-International-Airport-Corporation