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A Case Study

**STUDY OF NANOTECHNOLOGY APPLICATION IN
CONSTRUCTION INDUSTRY
(CASE STUDY: HOUSES IN BANGALORE)****Ajay Kumar Sahu^{1*}, Priyadarshini S S Harichandan², Rahul Nemani³,
Mojdeh Jamali Hessari⁴, Dr. Pratima Pradhan⁵**

1. Dept. of Microbiology, Bangalore University, Bangalore

2. Dept. of Biotechnology, Berhampur University, Odisha

3. Dept. of Microbiology, Bangalore University, Bangalore

4. Dept of Biotechnology, Bangalore University, Bangalore

5. Dept of Biotechnology, AMIT College, Odisha

Abstract:

Nanotechnology is a new technique of century and it is showing tremendous results in many fields like medical, pharmaceutical, agriculture etc. Applications of Nanotechnology in the food division are completely different in their usage in pharmaceutical industry. Nanotechnology can even be used in the future to treat life threatening diseases like cancer. However, it does have some drawbacks, for example, toxicity, environmental harm and organ damage caused by nanoparticles. Increasing demands for using new, high quality and more efficient materials in construction industry, meanwhile using less raw materials and energy has resulted in application of new modern technologies in this industry. One of the greatest modern technologies of current century is nanotechnology which can be useful in eliminating the needs of construction industry. The purpose of this paper is to study procedure and advantages of using this technology in construction industry, specifically in houses in Bangalore.

Key words: Nano, Nanotechnology, Building, House in Bangalore, nano of architecture.

Corresponding author:

Ajay Kumar Sahu,
Dept. of Microbiology,
Bangalore University,
Bangalore

QR code



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INTRODUCTION:

This technology improvement and also need for different structure has resulted in immense research in ascribe and behavior of material that in return, results in application of different material and also introducing different types of structures.

Nanotechnology as a key inter-disciplinary technology has created many opportunities in order to fortify the competition in construction industry like building faster, flexible, more desirable, more stable and more efficient :and application area for this technology applies to all most all part of building, including structure , exterior design, engineering (building systems)and interior design Nanotechnology is also referred to as the renaissance of technologies .Arrival of products related to this technology would lead to great at leap in quality of life and environmental efficiency. Construction industry has great expenses that besides construction costs, includes maintenance costs, too. Imagine a world where microscopic medical implants patrol our arteries, diagnosing ailments and fighting disease; where military battle-suits deflect explosions; where coumpter chips are no bigger than specks of dust. The amount of materials used and their strength and application would extensively increase and their variety and accordingly, their efficiency level would increase.

Because in sourthern regions of Bangalore, with its mild and humid climate, rainfall rate in most seasons of the year is extremely high, it makes multiple problems for construction industry of these regions, especially for houses. The application of nanotechnology is studied as the case study for this research because of its properties and as an efficient solution for houses in south of Bangalore; results show that by using nanotechnology in construction industry, energy and quality of life expenses drop extensively and most of design restrictions in these regions would be eliminated.

Research objectives and procedure

This paper for this purpose is to study the procedure of using nanotechnology in construction industry and its advantages, especially in houses of sourthern region of Bangalore. Research method in this paper is based on documentary studies and it is done by field research and descriptive-analytical study.

In studies section after a review of the concepts of nano and nanotechnology, application of nanotechnology in construction has been studied.

Theoretical foundations

Concept of nano

Still there is no internationally clear definition for nanotechnology but the definition they all agree with is to analyze and research study materials in nano scale. Accordingly, each and every research activity performed in scale under 100 nanometer is considered as nanotechnology (Globlabchi et al.,2011). Nano will grow to include more comprehensive information in the future. The plan for the rest of 2016 is to include information from a larger number of journals and to keep updating the database by including information from new publications. lexical definition of nano is one in a billion and it is derived from Greek word “nanos” which means midget (Moayed et al.,2009).

Concept of nanotechnology

In the following coumpound” nanotechnology”, nano refers to the scale of nanometer(nm) which is equal to one in a billion in a meter (Moayed et al.,2009). Nanotechnology as defined by size is naturally very broad, including fields of science as diverse as surface science, organic chemistry, molecular biology, molecular engineering, etc. Nanotecnology is a noun that refers to some kind of production technology and is achieved when there is the ability to build up things from atoms and if so, there is the ability to reshape materials accuracy.

Nanotechnology and buildings

Nanotechnology is a technological instrument that can survive with climate changes and help reduce the greenhouse gases emitted by fossil fules. Application of nanotechnology in construction industry is deeply related to substainability. Nano-architecture is a new architectural style of the 21st century that will revolutionize architecture can make changes in most aspect like changing architect’s vision, design technique and idea construction methods. In construction section, nanotechnology can be referred to as a kind of “empowering technology”. So far, most of the convincing topics related to the application of nanotechnology in architecture and construction industry have been about energy efficiency.

Generally, areas of construction industry in which nanotechnology might be able to the way for future evolutions can be abstracted to the followings

- ❖ New technology for processing multi-cultural products/works;

- ❖ Producing strong and intelligent materials besides repairing and renovating current structure;
- ❖ Modern and innovative system that can optimize the chain of “designing-production–utilization-demolition” in construction facilities. It is done by developing new tools and equipment based on information technology;
- ❖ New material production methods that effectively influence on decreasing water and energy consumption, in addition to producing much less waste products. Besides that developing production methods based on the environmental sustainability that can recycle construction products.

Case study and research findings

In this section, in order to explain the subjects, houses in southern regions of Bangalore are chosen as the case study. Some of these features may in some cases cause multiple problems such as water in filtration into the building, making fog, etc. Accordingly, the following content is dedicated to study the application of technology in different parts of these houses and its advantages.

Nanotechnology application in facade and rooftops of houses in southern region of Bangalore

Nanotechnology offers multiple solutions to improve exterior surfaces of a building in term of performance and aesthetics. Using nanomaterial, surface properties can be preferably modified against water and dust with verity of characteristics such as hydrophilic surfaces,

hydrophobic surfaces. Residential and commercial sectors with average growth of 7.5% compared to last decade, accounting for 39% of total energy consumption in this country, are considered to be the largest consumers of energy.

Nano insulation materials with 39 times more times more insulation ability compared to glass wool are among modern insulation materials. These materials can be easily applied on walls using hand brush, roller brush or air brush. Therefore, among the available instruction regarding energy consumption pattern correction, incorporating thermal insulator to the building shell is of great importance. Nano insulation is a new product of nanotechnology that is considered a sufficient thermal protection and insulation for all three modes of heat transfer including radiation and convection.

Application of thermal insulator in facade of houses in southern regions is imperative in building economy not only in terms of investment costs for construction but also in terms of operation costs.

Aerogel materials can also be used for transparent facades or roof windows thanks to their light-transferability. Aerogels are good light transmitters, changes direct light in to scattered light, eliminate the need for curtains, on cloudy days interior environment happens to be brighter than outside and because of their hydrophobic character.

	Materials	Nanomaterial	Prospects
1	Concrete	Carbon nanotubes/SiO ₂ /Fe ₂ O ₃	Sufficient reinforcement fraction prevention
2	Steel	COPPER nanoparticles	Improve weld quality improve oxidation resistance
3	Windows	TiO ₂ /SiO ₂	Self-cleaning ability Anti-fogging Prevent heat and ultraviolet infiltration Resistance against fire
4	Tints/coating	TiO ₂ /Silver nanoparticles	Anti-dirt/Bacteria and bug killing ability
5	Solar cells	Cover shade/TiO ₂ /Carbon nanotubes	More efficient application of solar energy
6	Sensors	Carbon nanotubes	On time structure safely evaluation
7	Cement	Carbon nanotubes/Polypropylene nanofiber	Improve strength Resistance against fire

Strong cover for protecting wood against atmospheric parameters

Nano-based wood protective coating that is sold under lingol brand name is a type of multi-purpose suffusing water-based cover that is used to protect wood against atmospheric parameters (especially on naked surfaces and exterior areas of buildings).

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water-based cover that is used to protect wood against atmospheric parameters (especially on naked surfaces and exterior areas of buildings). This coating has great hydrophobic, have ventilation and low vapour permeability so it is the best way of controlling moisture content of wood and by using that, maximum protection of wooden part is insured. This coating has great hydrophobic character that prevents water infiltration and adverse effects of rainfall the wood. Besides that, offers great protection against ultraviolet rays and prevents darkening of surface.

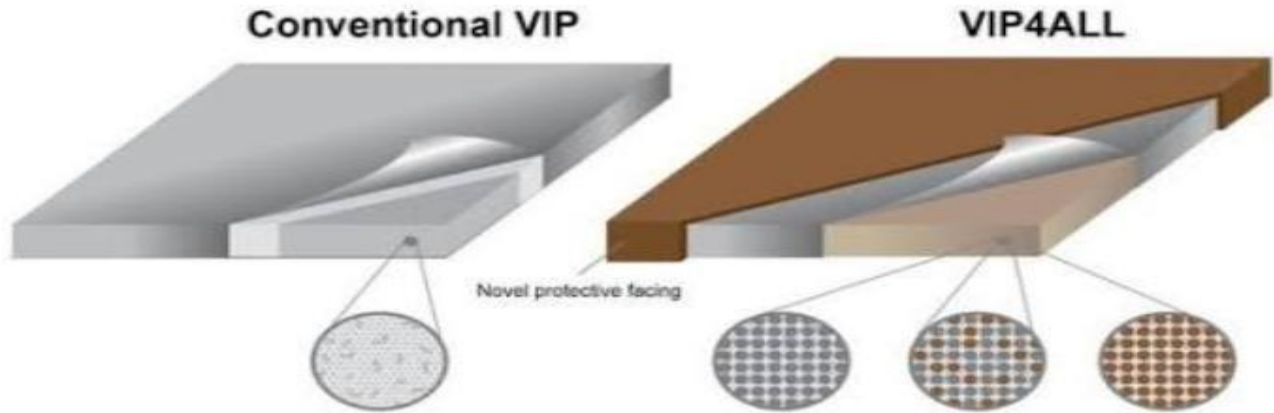


Fig 1: self cleaning ability of roof tiles with hydrophobic covers Resource

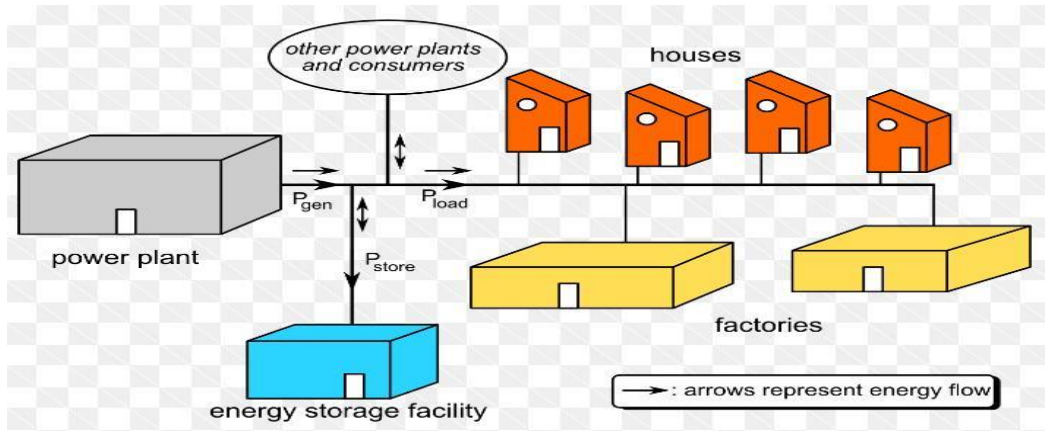
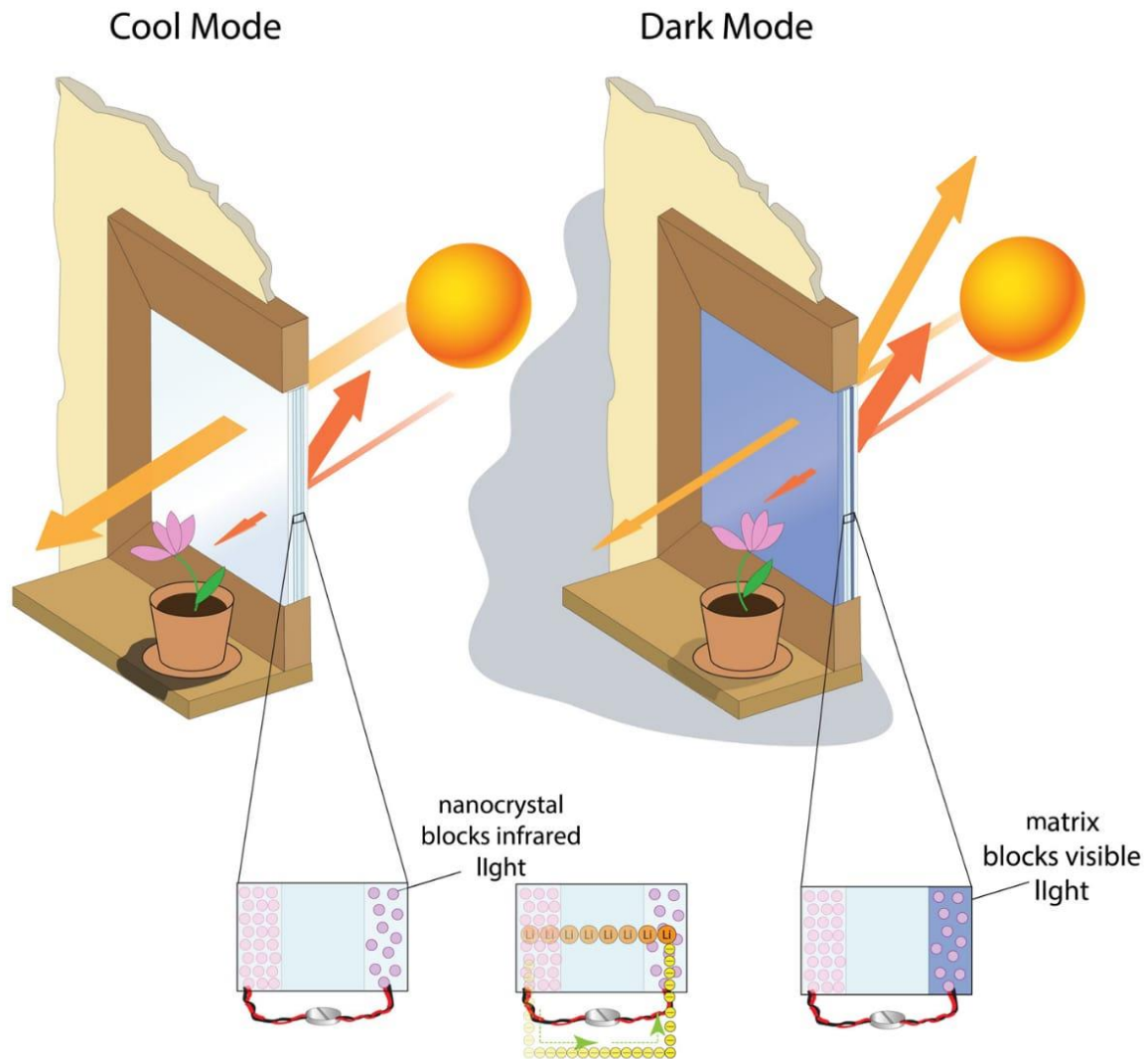


Fig 2 : Production method and application of insulation panels for saving energy, Source: ZEA Bayern



Nanotechnology application in windows

Nanophase technologies Co-oration launched a new line of innovative, Nano-enabled products that provide advanced levels of cleaning, polishing and protection for glass cleaning and window restoration applications, including commercial Class A, low- and high-rise buildings, residential homes and post-construction projects. Glass, because of its transparency and high resistance in any form and colour, is globally known as the construction material for windows and facade. But immediate dirt absorption, especially in houses in north of Bangalore,

undesirable reflection and bad performance as thermal insulator are considered as weak points for glass. Nano

cover considerably eliminate these weak points and by that, create new application areas for glass facades. For examples:

- ❖ Improve thermal protection using energy saving covers (Low-E)
- ❖ Antireflective coating using SiO₂ layer with nanohole arrays
- ❖ Antireflective coating for reinforced glasses with lighter transmission ability that, for

instance, are used on solar collector s and building windows are considered as impressive improvements of nanotechnology

- ❖ Solar protection(anti-UV) using colour-changing glass (Electrochromic glass)

“In today’s difficult economic conditions, building owner and facility manager are looking for ways to reduce building maintenance expenses” says Lynn Elliott, Presidents of Columbus window cleaning.

Nanotechnology may have the ability to make existing medical application cheaper and easier to use in place like the general practitioner’s office and at home. Nano technology also prominent role in the fast-developing field of tissue engineering. Transmission in plate glass energy saving glasses, besides having variety of colours and other properties, can prevent energy loss by up to 85% in summer and 80%in winter regarding the ability to drastically diminish the transition of ultraviolet and infrared rays and control visible light transition level. Energy saving glasses are made by applying multiple layers of metal and metal oxide/nitride on glass surface in controlled thicknesses. This nanocomposite fiber is almost 3-5 micron thick with a formulation relevant to the glass (nanotechnology magazine, issue 150). These glasses, although being colourless and transparent, have extra ordinary properties regarding energy and sunlight control level.

It also acts as thermal insulator in winter, absorbing heat radiated to windows inside and preventing heat extraction from inside, therefore minimizing the need for heating devices.

Using nanotechnology in cleaning surfaces

Nanotechnology is already being used in various cleaning products to make your life easier and have less environmental impact. Easy-to- clean surfaces are surfaces that are water-repulsive. These surfaces have less energy compared to absorbent surfaces that results in reduction of surface energy and grip.

Nanotechnology companies are finding way to make the world a cleaner place by exploring three methods for improving cleaning products. These methods are:

- ❖ Producing films that can be applied to surfaces such as countertops or windows that make it much easier to keep those surfaces clean.
- ❖ Using nanoparticles in soap that make it work better while producing less environmentally harmful by products.

- ❖ Using materials in the cleaning process that are antibacterial, such as silver nanoparticles. Nanotechnology application in creating anti- fog coating Southern region of Bangalore are usually covered with fog because pf its mild and humid climate; using this characteristics of nano ,surfaces can become neutral against fog and this advantage make creating architects’ vision of architectural designs possible.

Anti-fog coating are made of alternating layers of polymer and silica nanoparticles with hydroxyl groups attached to them and can be used on glass and other materials. This coating is very rough in nano scale but hydroxyl helps nano holes placed in different layer absorb water like a sponge and immediately remove that off the surface more efficient fuel cells in electricity and heat section suing natural gas.

Nanotechnology application in improving efficiency
Nanotechnology offers numerous options to improve productivity and develop new energy production methods and lighting technique in buildings, for instance:

- ❖ Light emitting diodes (LEDs)as a lighting technique with high energy efficiency for specific uses in building(facade lighting, guiding light and colour light)
- ❖ Colour solar cells with transparency and aesthetic(decorative) characteristics, like in glass facades as a replacement for silicon-based solar cells
- ❖ Core/shell nanostructures and catalyzers for more efficient fuel cells in electricity and section suing natural gas.

Nanotechnology gives us a modern technical tool that can copr with climate changes and helps us reduce the emission of greenhouse gasses in future. So far, improving energy efficiency of buildings has been the largest area that has challenged engineers to use nanomaterial in designing and engineering buildings.

RESULTS:

Because construction industry has great expenses regarding construction and maintenance costs, by relying on nanotechnology, besides increasing useful life of building, we can also manage the amount of energy consumption in a way for next generations. Houses in southern region of Bangalore in some cases are exposed to severe climate conditions and demand spending money, manpower and the time so that they can offer comfort. Applicaton of nanotechnology different part of these house, including exterior facade and openings, roof, etc. And eventually, all the

expenses spent on nanomaterial would return to the building. In order to achieve this goal and application of this technology in construction industry, we need to prepare required conditions and equipment, persuade educational centers and apply essential experiences of this field.

REFERENCES:

1. Moayed, F. Eslamipour, F. Moradi, M .A. New world, Nano world, 3rd Edition, Nano student-club, Atena publication.(in Persian).(2009).
2. SwapnaKutcharapati , A. K. Sankar ,N P Rajamane, Nanosilica improves recycled Concrete Aggregates,NBMCW,January2011
3. ARI News, Nanotechnology in Construction-One of the Top Ten Answers to World's Biggest Problem.
4. Mosayebi Jirandeh , A. Promoting nanotechnology (in Persian)(2008).
5. Hoseini , F. S. Mohammadi Yazdi, S. Nanotechnology application in construction industry (of Germany), Nanotechnology observation reports, science& technology department ,nanotechnology initiative council.(in Persian)(2012).
6. Baradarzadeh, M. and others, Nanotechnology,1st Edition, Tehran, Nano student-club (in Persian) (2008).
7. MaghsoudiAA,Dahooei F A (2009)Application of nanotechnology in self Compacting Concrete Design.IJE Transaction B:A pplication 22:229-244
8. Departement of Civil Engineering,SRM University,Kattankulathur,Chennai,India European Scintific Journal November edition vol.8.
9. Gopalakrishnan, K , Birgrission, B ,Taylor,P.,Attoh-Okine(2011),Nanotechnology in Civil Infrastructure Paradigm Shift,The Springer Book Archives(SBA)
10. J.B . Bai, A. Alloui, Effect of the length and T he Aggregate Size of MWNTs on The Improvement Efficiency Of The Mechanical And Electrical Propertiesof Nanocomposites – Experiment Investigation,Lab.MSS-MAT, CNRS UMR 8579,Ecole Centrale de Paris, Grande Voie Des Vignes, ChantenayMalabry CEDEX 92295,France Available Online june 2003.
11. Mann, S., “Nanotechnology and construction”, Nanoforum Report www.nanoforum.org,May 30,2008.
12. Gaan D., “A Review of Nanotechnology and its Potential Application for Construction”, SPRU, University of Sussex, 2002.
13. Francois De Larrard , “Concrete Mixture Proportioning: A Scientific Approach”, E & FN spon ,ISBN0419235000,p 440 ,1999
14. BASF ,<http://www.basf.de>.
15. Institute for Research in construction , ‘New IRC research project applies nanotechnology to construction to construction materials’, Construction Innovation 7(4) (2002).
16. National science Foundation, ‘Societal Implication of Nanoscience Nanotechnology’, USA, 2001.
17. DTI, ‘Constructing the future, Foresight report’,London,2001.
18. Ashwani K. Rana and Shashi B.” Significance of Nanotechnology in Construction Engineering, Civil Engineering, Civil Engineering & Construction Rieview,78-84, (2011).