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Reduction of Heat Gain Using Nano Materials

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***Abstract*—Nanotechnology is an art of new and modern technological process, which is based on the use of very small particles of material either by themselves or by their manipulation to make new large scale materials which their physical, mechanical and chemical properties become more affected This study aims at preventing heat gains in the building with the use of Nano materials and how do they become a good substitute to conventional materials. And understanding the traditional and conventional approach & limitation of conventional materials used for preventing heat gains in the building. Finding researching and analysing the new and alternative ways to subdue the heat gains by using Nano technology and Nano materials. A comparative analysis is conducted between a building using conventional materials and the same building using Nano materials in the given conditions.**

***Index Terms*— Nano technology, Nano materials, Conventional materials**

I. Introduction

Nanotechnology is a new technology that has been compared with the industrial revolution in terms of its impact on society. It is also important as a prototype of the technological opportunities and challenges that will characterize the 21st century. Recently, there are more than 600 manufacturer-identified consumer products are available on the market using nanotechnology. Which is projected will enable 15 percent of globally manufactured goods worth $2.6 trillion by 2014. The U.S. federal government budget for nanotechnology for fiscal year (FY) 2009 totals $1.5 billion. China, Japan, Korea and several European nations are vying with the United States for the spark advance in developing nanotechnology, and Russia recently announced a $5 billion for research and development program of nanotechnology (Elder 2007).

The implications of nanotechnology on building sector are introducing new potentialities for used materials. They lend building materials and opens entirely new physical and mechanical attributes. The key characteristic is not the fabric itself, but the size of the molecules. These are responsible for properties such as flame-resistance, durability and effectiveness. Applications of nanotechnology range from controllable adhesion and grip, tribiological aspects such as ultra-low friction, switchable magnetism or light absorption, conductive transparent surfaces, light diffusers and so on to insulation materials for constructions. The multitude of Nano technological products in this area underlines the economic relevance of such raw materials. Nanotechnology is an "enabling technology". It serves to improve existing products rather than creating entirely new products.

II. Nanomaterial in Construction

Tungsten Trioxide: electro chromic windows with Nano coatings, electro chromic windows consist of two glass panes (sandwich panel) with an electrically conductive, transparent coating. The interspace contains a sol-gel-layer of Tungsten Trioxide. Applying a small electric current (up to 3V) turns this Nano-structured coating blue and reduces the passage of sunlight through the laminated pane. The light and time depend on the size of the windows and can be between three and five minutes, which might be considered a disadvantage. As opposed to conventional Electro chromic window panes, no permanent power supply is required.

Aerogel: One of the main benefits of the aerogel insulation is its significantly lower thermal conductivity in comparison to traditional insulation materials. The insulation used on the 1921 villa is only 1 cm thick and its application therefore does not mean destructive action for the building architecture. The insulation was „inserted" under the core layer of the render without altering the building appearance. Aerogel material of similar type is used in astronaut space suits that have to meet strict criteria for thermal insulation performance and flexibility. The aerogel originally used and optimized for space sector finds vast applications in terrestrial architecture and in the near future also in other industrial branches (textile or car industry).

Indium Oxide: Indium oxide is soluble in water but soluble in acids. The role of such type of Nano compounds is basically used in some types of batteries, thin filmed infrared reflectors transparent for visible light, in some optical coatings and some antistatic coatings as well. Moreover, the substance is used in semiconductors too.

Titanium Dioxide (TiO_2): Titanium dioxide is a widely used white pigment. It can also oxidize oxygen or organic materials, therefore, it is added to paints, cements, windows, tiles etc. As TiO2 is exposed to UV light, it becomes increasingly hydrophilic (attractive to water), thus it can be used for antifogging coatings or self-cleaning windows.

Although there are many other Nano materials with vast properties which needs to be explored.

III. Use of Nano Materials

Reducing the heat transfer in a building is very important for reducing the need for space heating and cooling. Building envelope is the Major reason which tells the quality and controls the indoor conditions irrespective of impermanent outdoor conditions (Sadineniet al., 2011). The inputs to Envelope Related Energy Demand are areas of envelope elements (external walls, roofs and windows), U-values of envelope materials and site related parameters, concerning temperature and solar irradiation (Granadeiro et al., 2013).

The heat gain and fabric heat gain performance of the building model and sustainability is signage to accomplish optimal performance of buildings. Moreover, researches have shown that building envelopes contribute more than 50% of the embodied energy distribution in major building elements in residential buildings; it also contributes approximately 50–60% of the total heat gain in buildings (Mwasha et al., 2011)

IV. Methodology

Research on different Nano materials which can be used as construction material in a building, research based on different conventional materials which helps in preventing heat gains in the building. These materials are understood and analysed for its use and their applications in the building to maximize the effectiveness of heat prevention in the building. List of Nano materials which can be used in Building construction:

	Tungsten TRIoxide	Carbon nano tubes	SiO coatings	Paraffin spherules
Façade	Y	N	Y	Y
Internal building components	Y	N	Y	Y
Structural system	N	Y	N	N

	High performance concrete	Indium oxide	Aerogel	titanium dioxide
Façade	Y	Y	Y	Y
Internal building components	N	N	Y	N
Structural system	Y	N	Y	N

Understanding all the commonly practices conventional and traditional methods and

Noting down the various methods and materials which I can use for the new methods for reducing building heat gains.

Approaches to the envelope – walls and roof – or façade development with the integration of Nano materials and comparison to the conventional and Nano approach.

Creating a model in various software's by putting all the necessary details of the climate and the materials used. Then comparing the 2 models of both (conventional method and new method)

At last concluding the real fact on the basis of all the data, information, sources and the experiments.

V. Conclusion

Nano materials which were used in this empirical study are: - Nano gel glass & Nano vacuum insulated panels which did their job perfectly in the substitution of traditional materials in the applications of WALLS, ROOFS, and WINDOWS. By analysing the data, experimental or empirical study and its results, it can be concluded that Nano materials is very helpful in preventing heat gains in the buildings and have huge scope in the industry of architecture.

Hence, the Nano materials are Very Helpful in preventing the heat gains in a building and have a huge futuristic perspective to be used in architectural industry. It is still a long way to make them as a regular building construction materials because of availability, optimum applications, health risks and the costing of the materials.

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References

[1] Elder 2007, Granadeiro et al., 2013, Sadineniet al., 2011, Architectural Press, 2005.