



9th International Conference on Applied Energy, ICAE2017, 21-24 August 2017, Cardiff, UK

Energy Savings and Sustainable Construction: Examining the Advantages of Nanotechnology

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Abstract

Due to innovation and technological advancement, construction activities have continuously been subjected to alteration, modifications and changes in an attempt for the industry to meet the demands and aspiration of their clients. One of the technologies gaining popularity in the industry, especially in the developed ones, is nanotechnology, and this study explores the benefits of adopting the system for traditional construction materials with a view to enhancing sustainability of construction projects. Relevant literature materials were examined and seventeen advantages of nanotechnology were extracted and discussed. The factors were further assessed through the administration of closed-ended questionnaires on construction professionals with adequate knowledge of construction activities and associated materials. It was revealed that the adoption of nanotechnology will not only enhance the functionality of traditional materials but will also reduce carbon emission and reduce energy consumption. Other advantages of the method were discussed in this paper and to this end, there is need to create awareness of the system in the construction industry as its adoption will aid the achievement of sustainable infrastructures that will be useful and beneficial to the current and future generations of the society.

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Peer-review under responsibility of the scientific committee of the 9th International Conference on Applied Energy.

Keywords: Construction materials; Nanotechnology; Project success; Sustainable construction; Sustainable development.

1. Introduction

Nano, which by definition means dwarf adopted from the Greek, indicates one divided by a billion. One nanometer is indeed one divided by a billion, which by practical example is, about one divided by eighty thousands of the diameter of hair on a human [1]. Nanotechnology can be regarded as a 'catch-all' portrayal of exercises (any utilization of science and innovation) at the nanometer scale that have applications in this present reality [2]. Furthermore, nanotechnology

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depicts the creation and usage of useful materials, gadgets and frameworks with novel capacities that are construct either in light of geometrical size or on material-particular characteristics of nanostructures [3]. Nanotechnology in itself obtains a variety of definitions, but it basically refers to the scientific ability to manipulate and understand matter at highly microscopic scales or the nanoscale, say, from 0.1 run to 100 nm. The hugeness and significance of acquiring a related amount of control of matter at this particular scale, the nanoscale, is that at this scale, diverse laws of material science become an integral factor (quantum physics); metals and ceramics which form part of the group of traditional materials show new related functionalities and greatly improved properties, the behavior of surfaces starts to dominate the behavior of bulk materials, and whole new realms open up for us [4,5].

A wide scope of difficulties confronted by the development business, extending from the execution of the materials to safety and environmental issues, identify with materials and their properties. Recent advancements and developments in different regions of nanotechnology show noteworthy guarantee in helping to address these difficulties [6]. Therefore, this research study aims to identify the advantages of which development and application of nanotechnology can instill in traditional construction materials, such as concrete, steel, glass etc. which would directly aid sustainable construction.

2. Nanotechnology and Sustainable Construction

The construction industry constitutes a critical sector of national economies throughout the world, both in developing and in developed nations [7], for instance, in 2013, it added up to 5.7% of the European Union's gross value. In the meantime, the construction industry has been helping in aiding sustainable development goals in the areas of social cooperation, society creation and for the indigenous environment (resources usage and asset utilization, air outpourings, water use, arrive utilize, fermentation, hurtfulness/harmfulness, squander creation, vitality use being the critical issues to consider). Sustainable or environmental technologies are defined as those which are (or are potentially) available that could contribute to helping diminish human weights on the earth or natural resources while at the same time maintaining desired standards of living [8].

The market for sustainable buildings is expanding as the development business has perceived that they may reduce some negative impact on the earth and bring essential social and ecological advantages [9]. Therefore, selecting inappropriate materials may influence the performance of the building and may directly inhibit the accomplishment of the coveted sustainability goals [10]. In the coming years, with its infrastructure, urban growth will continue to produce extreme impact on the natural environment stemming from the consumption of energy, the utilization of materials and the growing consumption of raw materials. However, previous studies have revealed that nanotechnology is on course to accomplishing genuine, aggressive and practical development as well as advancement of development business [3,4,5]. This implies that if the potential for an era of durable and viable construction materials are to be realized, there is a need for the application of nanotechnology to traditional construction materials, and this will help in ensuring sustainability of various materials in the construction industry.

Properties of most construction materials can be measured but some are subjective and non-quantifiable [11]. Among the quantifiable properties, economical materials are portrayed as materials with high reused content, low-discharging contaminants, fast renewable periods, high reused content, free of unsafe contaminants, low expending, and low reparable and very drawn out [12,13]. Non-quantifiable properties are additionally credited to economical materials, for example, simple to work with, safe to utilize, exceptionally fulfilling to the client, something the general population needs, accomplish more with less, socially and innovatively rewarding [13,14]. Therefore, the application of nanotechnology to traditional construction materials promises the existence of relevant and desirable properties in those materials, which may then result in the general achievement of sustainability of construction projects.

The model of sustainability has become a mainstream matter of interest not only among organizations, but also government agencies and the general public [15]. While the goal of organizations' activities remains economic performance, there has been consideration for the reduction of negative effects on the natural environment while also giving attention to the third aspect of social sustainable practice [16]. However, socio-economic and modern engineering advances are contributing factors for sustainable development in the construction industry [17]. For instance, in the last few decades, governments and businesses began to adopt more sustainability dimensions in their policies and economic activities, while an increasing number of companies rely on sustainability indicators to assess their level of corporate social responsibility (CSR) [16,18]. Sustainable construction can make a huge difference to

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