

A Brief Review on the Importance and Application of Nanotechnology

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Abstract:- Nanotechnology is the area of technology where different materials are manipulated to some nanometre (10^{-9} m) scale either up by bottom up from single group of atoms to bulk matter or by top down which is reducing bulk materials to a group of atom. Nowadays, nanotechnology is being considered for the fabrication and manufacturing of many electronic devices, in medical equipments, medicines, cells and fabrics. Nanotechnology is used for finding a wide variety of ways to deliberately make materials at the nanoscale to take advantage of their enhanced properties such as higher strength, lighter weight, increased control of light spectrum, and greater chemical reactivity than their large scale counterparts. This technology is specially used in the field of semiconductor industry. In this paper we have done descriptive review of nanotechnology. We also analysed the future applications of nanotechnology in electronic and medical industries.

I. INTRODUCTION

Nanotechnology is the technology or the study of extremely small structure having size of 0.1 to 100nm. It is used for better built, longer lasting, cleanser, safer and smarter products for home, communication, medicine, transportation, agriculture and many other applications. Like other technologies, nanotechnology requires proper knowledge and skills from many different fields such as physics, chemistry, biology, electrical engineering, mechanical engineering, computer science, etc [1].

II. APPLICATIONS OF NANOTECHNOLOGY

A. Nanotechnology in Medicines-

The use of nanotechnology in medicine offers some exciting possibilities. Nanotechnology in medicines involves some applications of nanoparticles which are currently under development as well as research which involves the use of manufactured nano robots which are used to make repairs at the cellular level and are known as nanomedicines. The use of nanotechnology in the field of medicine could revolutionize the method in which we detect and treat damage of the human body [2].

B. Nanotechnology in Electronics-

Nanotechnology has contribution in computing and electronics, leading to faster, smaller, and more portable systems that can manage and store larger and larger amounts of information. These continuously evolving applications include:

- Transistors, the basic switches that enable all modern computing; have gotten smaller and smaller through nanotechnology.
- Ultra-high definition displays and televisions are now being sold that use quantum dots to produce more vibrant colors while being more energy efficient
- Nanoparticle copper suspensions have been developed as a safer, cheaper, and more reliable alternative to lead-based solder and other hazardous materials commonly used to fuse electronics in the assembly process [3].

C. Nanotechnology in Food-

Nanotechnology is used in several aspects of food science, from how it is grown to how it is packaged. Companies are developing which makes a difference not only in the taste of food, but also in food safety, and also in the health benefits that food delivers. Clay nanocomposites are being used to provide an impermeable barrier to gases like oxygen or carbon dioxide is used in lightweight bottles, cartons and packaging films. Storage bins are manufactured with silver nanoparticles embedded in the plastic. The silver nanoparticles kill bacteria from any material that was previously stored in the bins to minimizing health risks from harmful bacteria [4].

D. Nanotechnology in Space-

Nanotechnology is also used in making space flight. Advancement in nanomaterial makes lightweight solar cells and a cable for the space elevator possible. By reducing the amount of rocket fuel required, these advancements will lower the cost of reaching orbit and travelling in space. In addition, new materials combined with nanosensors and nanorobots will improve the performance of spaceships, spacesuits, and the equipment used to explore planets and moons, making nanotechnology an important part of the final frontier [5].

E. Nanotechnology in Energy-

Nanotechnology has application in energy sources and is greatly enhancing alternative energy approaches to meet the world's increasing energy demands. Many scientists develop clean, affordable, and renewable energy sources, along with means to reduce energy consumption and less toxicity burdens on the environment. Nanotechnology also improves the

efficiency of fuel production from raw petroleum materials through better catalysis. It is also used in reduction of fuel consumption in vehicles [6].

F. Nanotechnology in Fuels-

Nanotechnology is used for producing the fuels from low grade raw materials more economical and also for producing the fuels from normal raw materials more efficiently. This can be done by increasing the effectiveness of catalysts as it reduces the temperature to convert the raw materials into fuel or increase the percentage of fuel burned at a given temperature. Catalyst made from nanoparticles has larger surface area so that they interact with the reacting chemicals. The greater surface area allows more chemicals to interact with the catalyst which makes it more effective. This will increase the effectiveness in the production of diesel fuel from coal more economical [7].

G. Nanotechnology in Chemical And Biological Sensors-

By nanotechnology sensors are able to detect very small amount of chemical vapours. Various types of detecting elements, like carbon nanotubes, zinc oxide nanowires or palladium nanoparticles are used in nanotechnology based sensors. These elements change their electrical characteristics, like resistance or capacitance when they absorb a gas molecule. Because of its small size, a few gas molecules are sufficient to change the electrical properties of the sensing elements. This allows the detection of a very low concentration of chemical vapours. The goal is to achieve small, inexpensive sensors that can sniff out chemicals just as dogs are used in airports to smell the vapours released by explosives or drugs [8].

H. Nanotechnology in Transportation-

Nanotechnology is also used to improve transportation infrastructure. Nanoscale sensors and devices provides cost effective continuous monitoring of the structural integrity and performance of bridges, tunnels, rails, parking structures, and pavements over time. Nanoscale sensors, communication devices and other innovations enabled by nano electronics provide an enhanced transportation infrastructure which communicates with vehicle based systems to help driver to maintain lane position, avoid collisions, and adjust travel routes to avoid congestions [9].

I. Nanotechnology in Fabrics-

Using nano sized particles for making fabric improves fabric properties without increasing in

weight, thickness, or stiffness which occurs in the case of previously used techniques [10].

J. Nanotechnology to detect the Water Pollution-

Nanotechnology is used for the solutions of three different problems in water quality.

- The first problem is the removal of industrial water pollution, like cleaning solvent called TCE, from groundwater. Nanoparticles are also used to convert the contaminating chemicals to make it harmless.
- Another problem is the removal of salt or metals from water. A deionization method using electrodes composed of nano sized fibres are used for reducing the cost and energy requirements of turning salt water into drinking water.
- The third and the last problem is that the filters do not work on virus cells. A filter only a few nanometre in diameter is currently being developed which are capable of removing virus cells from water [11].

III. CONCLUSION-

The use of nanotechnology spreads widely across the globe. In the study, we have learned that in the near nanotechnology is going to make an individual's life simpler and easier than now. By the use of nanotechnology many smart applications becomes real in our life, through which our devices becomes small and small to facilitate many important aspects for human life. This paper surveyed some of the most important applications of nanotechnology with particular focus on what is being actually done in this field.

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