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Nanotechnology and its Potential –"Big things from Tiny World"

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ABSTRACT

The purpose of this paper is to look into present aspects of "nanotechnology". This paper gives a brief description of what nanotechnology is? And its application in various fields. It also deals with the future perspectives of nanotechnology as Its immense potential promises the possibilities of significant change of future. Various risks involving in using Nanotechnology are also discussed because it is believed that the most disruptive future changes may occur as a result of molecular manufacturing , an advanced form of nanotechnology.

KEYWORDS

(Nanotubes,Nanofilms, nanomedicines , molecular nanotechnology, nanotubes, nanomedicines)

INTRODUCTION

The word "Nano" derived from Greek word nanos means "dwarf" and technically refers to the dimension of 10^{-9}. Since the size of most of the nanoatoms is 0.1 – 0.2nm, Nanotechnology refers to the technique that has ability to work with individual atoms and molecules. This is akin to playing with nature's basic building block. When man escaped the limitation of macro enters into nanodomain, totally new properties of elements are encountered at this level. In quantum physics, behavior of atoms and molecules are entirely different at micro level but as they aggregate their behavior changes. Since 1959, when Richard Feynman speculated on the potential of nanotechnology in his speech "There is plenty of room at the bottom" to build practical application based on it has fascinated scientific community. Later discoveries and invention like STM (scanning tunneling microscope) that works on atoms revolutionized the fields. Today, scientist are able to create carbon nano tubes for wide range of applications requiring strength enhancement. Nanoparticles have application in wide variety of fields like textiles, biomedical, healthcare, food, agricultural,industrial, electronics, environment and renewable energy. While USA, germany and japan lead RND in nanotechnology, India is cathing up. Nanotechnology promises in all new future domain, if the promises are fruitfully realised.

SCALE COMPARISON

In order to understand the unusual world of nanotechnology, we need to get an idea of the units of measurements involved. A nanometer is one billionth of a meter, smaller than the wavelength of visible light. Below are the size of some substances in nm scale.

Size	**10^0nm**	**10^1nm**	**10^2nm**	**10^3nm**	**10^4-10^5nm**	**10^6nm**
	glucose	antibiotics	Virus	bacteria	Cancer cells	A dot

NANOTECHNOLOGY TIME LINES

Nanotechnology is not new to us. The romans and Chinese were using nanoparticles thousands of years ago. What is new about nanotechnology is our ability to not only see, and manipulate matter on nanoscale. Here we dicussed nanotechnology time lines in brief.

- 4^{th} centuary ,the Lycurgus glass (rome) which is colloid gold and silver composed dichoric glass.

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- 6- 15th centuary, stained glass windows in European cathedrals had nanoparticles of gold chloride.
- 9-17th centuary, lusture ceramic bowls used in Islamic world has silver or copper nanoparticles.
- In 1857 , Michael faraday discovered colloid ruby gold.
- In 1936, Erwin muller invented the field emission microscope.
- In 1947, bardeen, Shockley and brattan of bell labs discoverec the semiconductor transistors lying the foundation of IT age.
- In 1956, now scientist realized that they can work on microlevels so, Arthur hippel points the term "molecular engineering".
- In 1958, jack kilby built the first integrated circuits.
- In 1959, Richard Feynman famous lecture "there is plenty of room at the bottom".
- In 1965, intel co- founder gordon moore coins the moore's law.
- In 1974, Tokyo university professor norio taniguchi coined the term "nanotechnology" to describe precession machining of materials within atomic dimensions.
- In 1981, gerd binnig and Heinrich rohrer invent STM (scanning, tunneling microscope) allowing scientist to see atoms.
- In 1985, buckminister fullerene or C_{60} or buckyball discovered.
- In 1989, don eigler or erherd schweizer manipulate the 35 xenon atoms to spell word IBM.
- In 1991, sumio lijima discovered CNT (carbon nanotubes) shares the kevli price in 2008.
- In 1999, mirkin group north western university invents dip pen nanolithography (DPN) leading to manufacturable, reproducible, writing of electronic circuits.
- In 2000, consumer products based on nanotechnology appear in the market. Example- nanosilver antibacterial socks, automobile bumpers that resist scratches. Golf balls that flies straighter.
- In 2006, james tour built a nanocar made of phenylene, ethylene with $4C_{60}$ buckyballs.

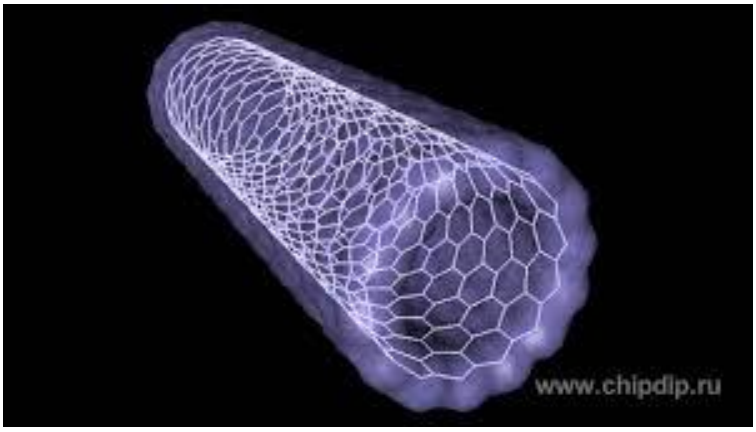
SOME IMPORTANT TERMS

"FEYNMAN FAMOUS SPEECH"

On December 1959, American physicist Richard Feynman lectured on "there is plenty of room at the bottom". This speech provides inspiration on topic nanotechnology. Feynman describes the process by which the ability to manipulate individual atom and molecule may be developed.

"CARBON NANO TUBES"

Carbon nanotubes are the allotropes of carbon with cyclindrical nanostructures so far nanotubes have been made with length to diameter ratio of 13,20,00,000: 1, which is higher than any other material. They have long hollow structures with walls formed by one atom thick sheets of carbon called graphene. Unique chemical bonding of sp^2 bonds gives nanotubes huge strength. Currently, bulk nanotubes are used In polymers to improve the mechanical, thermal and electrical properties.



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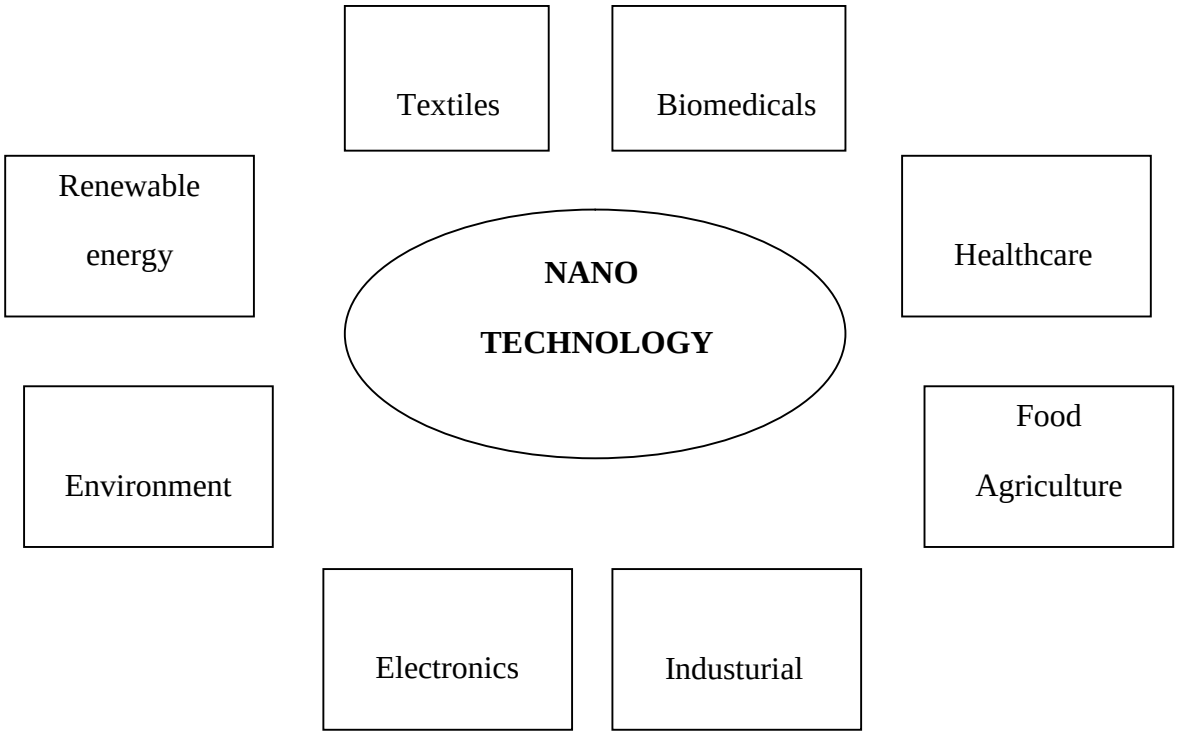
"NORIO TANIGUCHI"OR "NANOTECHNOLOGY"

The japnese scientist use this term in 1974 to describe semiconductor processes such as thin film deposition on the order of nanometer. He said "nanotech mainly consist of the processing, separation, consolidation and deformation of materials by one atom or one molecule".

"BUCKYBALLS"

Buckminister fullerene is a spherical fullerene molecule with the formula C_{60}. It is made up of 20 hexagons and 12 pentagons. A fullerene molecule is any which is made of only carbon either like a sphere or an ellipsoid or tube or any other shape. Spherical fullerene resembles footballs and hence the name buckyballs. Cyclindrical once are called carbon nanotubes (bucky tubes). Fullerenes are just like graphite.

APPLICATIONS OF NANOTECHNOLOGY



1. **In textiles**- scientists are using nanoparticles to enhance clothing. By coating fabrics with a thin layer of zinc oxide nanoparticles, manufacturers can create clothes that give better protection from uv radiation that is uv blocking textiles. With the help of nanotechnology ,electroconducting textiles, medical textiles,antistained textiles, medical textiles are also possible. Some clothes have nanoparticles in the form of little hairs that help to repel water and other materials ,making the clothing stain resistant.
2. **In biomedical**- The delivery of any drug at the right time and in the target where it is needed and at the level that is required is essential to realize the full potential of therapeutic molecules. These requirements are more important in the case of cancer chemotherapies due to their high toxicity which could lead to serious side effects. In biomedicals , nanotechnology has a vast applications like cancer therapies, biomarkers, wound dressing, molecular tagging and many more.
3. **In Healthcare** – many sunscreens contain nanoparticles of zin oxide or titanium oxide that provides uv protection and prevents sunburns.
4. **In Food, agriculture** – by applying antifouling coatings on food particles prevents the food to get foul. There are some other uses of nanotechnology as food processing catalyst, interactive food , food packaging etc.
5. **In Industrial** – used in industries as antimicrobial coatings, wear resistantant coatings, self cleaning surfaces ,reinforced plastics, functional composites etc.
6. **In Electronics** – nano technology have a vast technology in the field of electronics as quantum computers,high density data storage,sensors,single electron transistors,quantum lasers,Reducing the size of transistors used in integrated circuits.One researcher believes it may possible to “put the power of all of todays present computers in the palm of your hand.”
7. **In Environment**-nano scale materials that have great potential to filter and purify water include nano scale titanium dioxide that is waste water treatment.
8. **In Renewable energy**-nano technology is used in the field of renewable energy as a fuel cell catalyst, paint on solar cells and hydrogen production photo catalyst.

RISKS OF NANO TECHNOLOGY

As soon as molecular manufacturing was proposed risks associated with it began to be identified.Enginees of creation described one hazard possible:grey goo.A small nano machine capable of replication could in theory copy itself to many types.if it were capable of surviving outdoors,and using biomass as raw material,it could severely damages the environment.Destructive nano machines could do immense damage to unprotected people and objects.If the wrong people gained the ability to manufacture any desired product, they could rule the world,or cause massive destruction in the attempt.

CONCLUSIONS:

With the continue use of nano technology, the global lifestyles will change radically.Today,many of our nations most creative scientists and engineers and finding new ways to use nano technology to improve the world in which we live they see doctors dectecting diseases at its earlier stages,picture new technologies for protecting both our military forces and civilians from biological and chemical weapons.

Developments of nano technology must be undertaken with care to avoid accidents.Ones a nano technology based manufacturing technology is created,it must be administered with even more care.irresponsible use of molecular manufacturing could lead to black markets,unstable arms races ending in immensed destruction and possibly are release of grey goo.

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