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10. Nano-Technology and Its Relevance in Higher Education

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Abstract:

This paper outlines about the Nanotechnology and its need and importance in higher education and examines how will work Nanomaterial's in modern era or in future. Significant paper exists relating to the question of whether Nanotechnology or Nanotechnology bared product merit special government regulation this paper is related to the circumstances in which it is necessary and appreciate to assess new substances prior to their release into market, community and environment.

This technology can be the combination of science and engineering involved in the design, synthesis, and uses of materials and devices whose smallest functional organization in at least one dimension is on the nanometer scale. At these scales, consideration of individual molecules and interacting groups of molecules in relation to the bulk macroscopic properties of the material or device becomes important, hence it is control over the basic molecular structure that allows control over the macroscopic chemical and physical properties.

Applications to medicine and physiology imply materials and devices designed to interact with the body at molecular scales with a high degree of specificity. This can potentially translate into targeted cellular and tissue-specific medical applications designed to get maximum therapeutic affects with minimum side effects. In this article the main scientific and technical aspects of nanotechnology are introduced and some of its significant clinical applications are discussed.

Keywords:

Manipulation of matter, Nanomaterial, Nanoscale, Molecular Nanotechnology, Bottom up approaches and top - down approaches. Nanocomposites, nanocataysts.

10.1 Introduction:

At atomic and molecular scale, there is the manipulation of matter in Nano technology. Generally, it works with materials, devices and other structures with at least one dimension sized from 1 to 100 nanometers with a variety of potential application, neonate is a key technology for the future and government have invested billions of dollars in its research. It is very diverse, ranging from extension of conventional device physics to completely new approaches bared upon molecular self-assembly, from developing new materials with dimension on the Nano scale to direct control of matter on the atomic scale.

Nanotechnology implicates the application of fields of science as diverse as surface science, chemistry, molecular biology, semiconductor physics, micro fabrication etc. It may be able to create new materials and devices with a vast range of applications, such as in medicines, electronics, biomaterials and energy production. On the other hand, Nanotechnology varies many of the same issues as any new technology including concerns about the toxicity and environmental impact effects on the global economics, as well as speculation about various doomsday sceneries.

K. Eric Drexler developed the concept of Nanotechnology and founded the field of molecular Nanotechnology. The coming era of Nanotechnology, which proposed idea of "Nanoscale assembles" which would be able to build a copy of itself and of other items of arbitrary complexity Drexler's vision of Nanotechnology is after called "Molecular Nanotechnology.

Government moved to promote & found research into Nanotechnology with programs such as the national Nanotechnology initiative. The early 2000 also saw the beginnings of commercial application of Nanotechnology although there were limited to bulk application of Nonmaterial. Such as the silver Nano platform for using silver Nan particles as an antibacterial agent, Nonparties- based transparent sunscreens, and carbon Nanotubes for stain resistant textiles.

In the original sense, Nanotechnology refers to the projected ability to construct items from the bottom up, using techniques and tools being developed today to make complete higher performance product.

10.2 Approaches Used in Nanotechnology:

Two main approaches are used in Nanotechnology:

1. Bottom-up approaches
2. Top-down approaches

10.2.1 Bottom-Up Approaches:

In the "Bottom-up" approach, materials and device are built from molecular components which assemble themselves chemically by principles of molecular recognition.

DNA Nanotechnology utilizes the specificity of Watson- crick base pairing to construct well defined structures out of DNA and nucleic-acids.

Approaches from the field of classical chemical synthesis (inorganic and organic synthesis) also aim at designing molecules with well-defined shape. (eg- bis- peptides).

There is a scanning probe lithography technique where an atomic force microscope (AFM) tip is used patterns directly on a range of substances with a variety of inks.

10.2.2 Top-Down Approaches:

In the "top-down" approach involves the breaking down of bulk materials in Nano sized structures or particles. Top down synthesis technique are extension of those that have been used for producing micron sized particles.

A material such as gold (chemically inert) can serve as a potent chemical catalyst at Nanoscale much of the fascination with Nanotechnology stems from these quantum and surface phenomena that matter exhibits at the Nano scale.

Many technologies that descended from conventional solid state silicon methods for fabricating microprocessors are now capable of creating features smaller than 100hm, falling under the definition of Nanotechnology.

Nanoelectromechanical system (NEMSs) is devices that constitute electrical and mechanical functions at the Nanoscale. It consists of miniature electrical and mechanical apparatuses such as beams, sensors, pumps, resonators and motors etc.

Focused ion beams can directly remove material or even deposit material when suitable precursor gasses are supplied at the same time.

10.3 Nanomaterials:

The Nanomaterials field includes subfields which study materials having specific properties arising from their Nanoscale dimension.

- Interface and colloid science has given rise to many materials which may be useful in Nanotechnology and other fullerenes, and various Nonparties and Nanorods Nanomaterials with fart ion transport are related also to Nanoinonics and Nanoceectonics.
- Nanoscale materials can also be used for bulk application most present commercial applications of Nanotechnology are of these flavors.
- Progress has been made in using these materials for medical application.
- Nanoscale materials are sometimes used in solar cells which combats the cost of traditional silicon solar cells.

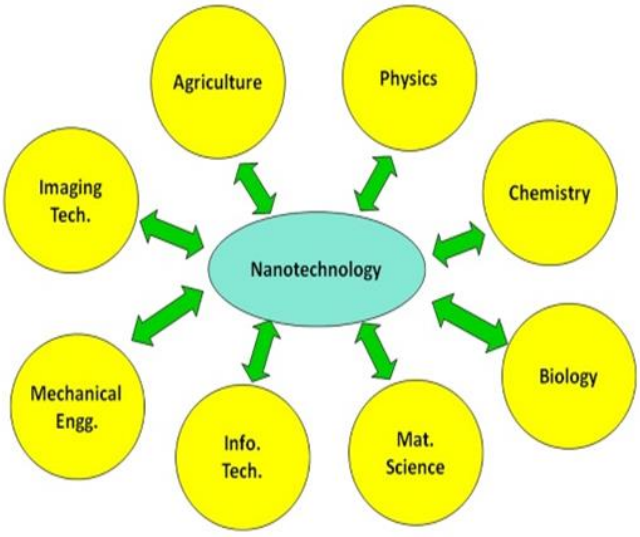
- Development of application incorporating semiconductor Nanopartices to be used in the next generation of product such as display technology lighting solar cells and biological.

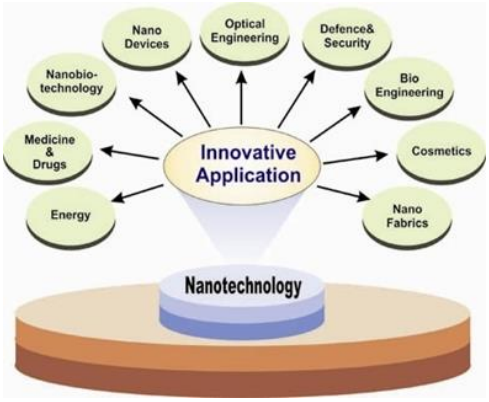
10.4 Application:

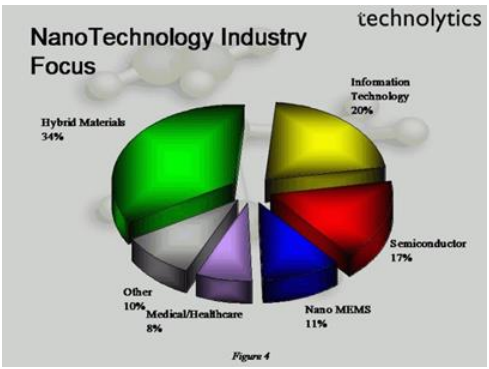
One of the major applications of Nanotechnology is in the area of Nano electronics with MOSFET'S is being made of small Nanowires ~ 10nm in length.

The 2000S has seen the beginning the application of Nanotechnology in commercial products, although most application are limited to the bulk use of passive Nanomaterials eg- include titanium dioxide and zinc oxide Nanoparticles in sunscreen, cosmetics and some food product. Silver Nonparties in food packaging clothing application such as silver Nano carbon Nanotubes for stain resistant textiles and cerium oxide as a fuel catalyst.

a. Nano medicine
b. Green Nanotechnology
c. Energy applications of Nanotechnology
d. Industrial application of Nanotechnology
e. Potential application of carbon Nanotubes.
f. Group improvement
g. Nano biotechnology
h. Analysis of gane expression and regulation
i. Soil management
j. Plant disease diagnostics
k. Water management
l. Precision agriculture
m. Bioprocersing
n. Post-harvest technology.





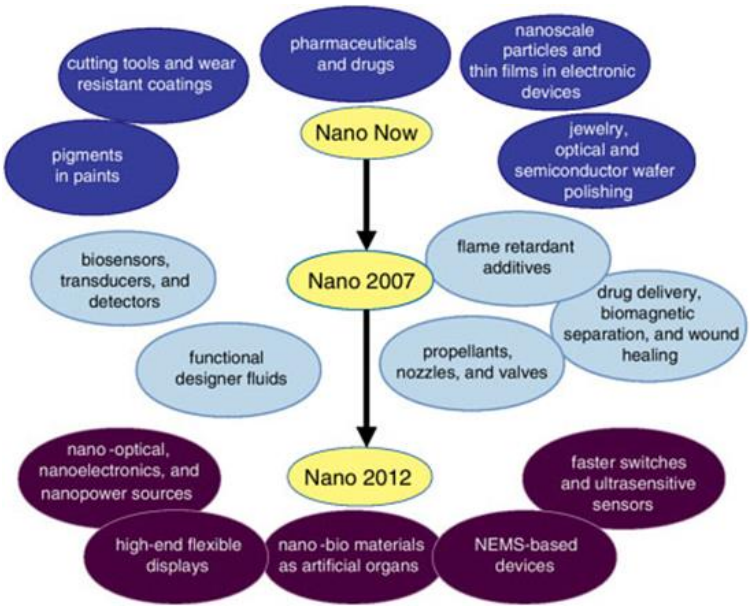


10.5 Nanotechnology in Present:

Today, Nanotechnology is among the fastest growing areas of science and technology with exponential progress being made. The first integrated circuits using three dimensional carbon Nanotubes these could be vital in maintain the growth of computer power, allowing Moore's law to continue Solar panels with greater effacing through the use of Nanomaterials composites.

Nano structured polymers in display technologies allowing brighter images lighter weight less power consumption and wider viewing angles. Nanotechnology surface which are highly resistance to bacteria dirt and scratches. New fabrics that are highly resistance of liquid caring it to simply fall off without Leaving any dampness or stains. Nano structured catalysts used to make chemical manufacturing processes more efficient saving energy reducing waste products.

Some Examples of How Nanotechnology Impacts Our Lives Now:



10.5.1 Nano Composites:

Researchers have developed a coating process to make sponge-like silica latch onto toxic metals in water. Self-Assembled Monolayer's on Mesoporous Supports simply captures such metals as lead and mercury, that area unit then recovered for reprocess or contained in place forever. PNNL One is an example of a SAMMS nanocomposite (Self-Assembled Monolayer's on Mesoporous supports) An hexagonally close-packed cluster of tubular pores (end view) is shown in the foreground. A single pore, during this case coated with a mercaptopropylsiloxy, is shown with in the background.

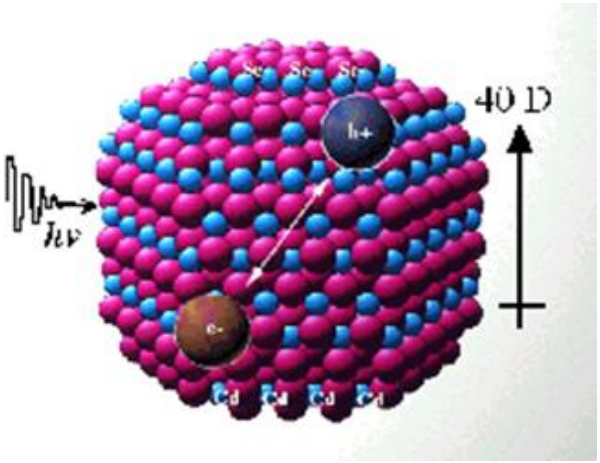
- **Impact:**

Will likely be used on other GM and Toyota models soon, and in other areas of their vehicles, as well as the other auto manufactures, lowering weight, increasing mileage, and creating longer-lasting autos. Likely to impact repair shops (fewer repairs needed) and auto insurance companies (fewer claims). Except National Aeronautics and Space Administration, the ESA, and different space-faring organizations to require a significant look, soon, which is able to eventually lead to lower raise prices, which is able to lead to additional material being upraised into area.

- **Nanocrystals:**

Nanocrystals of many metals have been shown to be 100 percent, 200 percent and even as much as 300 percent rigid than the same materials in bulk form. Because wear resistance often is dictated by the rigidness of a metal, parts made from nanocrystals might last significantly longer than conventional parts. The nanocrystalline coating of silver fastly kills a broad spectrum of bacteria in as little as 30 minutes. "In photovoltaic devices, Nano crystals are the perfect light harvester. They absorb sunlight more strongly than dye molecules or bulk semiconductor material; therefore, high optical densities can be attained

while maintaining the requirement of thin films. Perfectly crystalline CdSe nanocrystals are also an artificial reaction center, separating the electron hole pair on a femto second timescale. Fluorescent nanocrystals have several benefits over organic dye molecules as fluorescent markers in biology. They are incredibly bright and do not deteriorate. Drug-coupled nanocrystals attach to the protein in an extracellular fashion, enabling movies of protein trafficking. They also form the basis of a high-throughput fluorescence assay for drug discovery."



10.5.2 Nanoparticles:

Sunscreens are utilizing nanoparticles that are extremely effective at absorbing light, especially in the ultra-violet (UV) range. Due to the size of particle, they unfurl more easily, cover better, and save money since you use less. And they are transparent, unlike traditional screens of white color. These sunscreens are so successful that by 2001 they had captured 60% of the Australian sunscreen market.

- **Impact:**

sunscreen maker has to convert to using nanoparticles. And other product manufactures, like packaging makers, will find ways to assimilate them into packages to decrease UV exposure and successive spoilage. The $480B packaging and $300B plastics industries will be directly consummated.

By the use of aluminum nanoparticles, Argonide has created rocket propellants that burn at double rate. They also produce copper nanoparticles that are incorporated into automotive lubricant or the reduction of engine wear.

AngstroMedica has produced a Nano particulate-based synthetic bone. "Human bone is made of a calcium and phosphate combindly called Hydroxyapatite. By manipulation at molecular level of calcium and phosphate, we have created a patented material that is similar in structure and composition to natural bone. This synthetic bone can be used in the treatment of fractures and soft tissue injuries."

10.5.3 Nanostructured Materials:

OLED color screens (made of nanostructure polymer films) which is produced by Kodak used in car stereos and Mobiles. OLEDs (organic light emitting diodes) may enable lighter, more flexible, thinner, less power consuming displays, and other consumer products such as cameras, PDAs, laptops, televisions, and other as yet undreamt of applications.

10.5.4 Nanotubes:

Nanoledge (a company) makes carbon Nanotubes. Carbon Nanotubes are frequently used for commercial purpose such as mundane (marketing tactic) use is in a tennis racket. The yoke of the racket bends less by the effect of ball. As a result, the performance of players is improved.

- **Impact:**

Once companies like Nanoledge can ramp up their production from grams, to pounds, to tons, then world becomes their oyster: everywhere strength and weight are a factor - such as in the aerospace, automobile, and airplane industries - they will make a major impact.

10.5.5 Nano catalysts:

All nanoparticles have been used from the outset in the manufacture of automotive catalytic converters: The surface area of the particles increases perilously as the particle size decreases and the weight remains the same. Many chemical reactions only take place on the surface of the catalyst. The area of surface and activity of catalysts are positively correlated. As larger the surface area, the more active the catalyst. Thus Nanoscale catalysts are the boon for many chemical process because by the use of Nano scale catalysts, the rate of chemical reaction increases effectively.

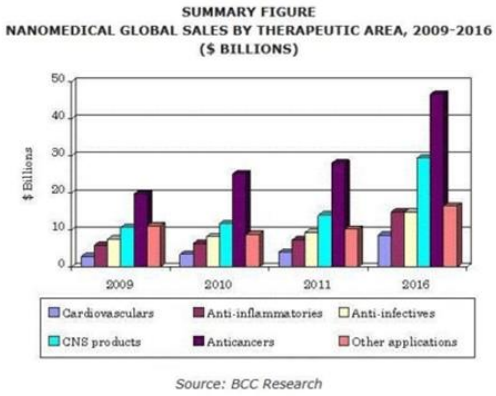
Shenmue Group (china's largest company) has licensed technology from Hydrocarbon Technologies that will enable to liquefy coal and turn it into gas. In this process a gel-based Nanoscale catalysts are used, which increases the efficiency and reduces the cost.

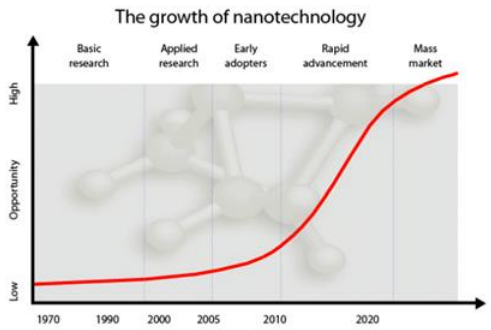
- **Impact:**

"If the technology keeps up its promise and can economically convert coal into gasoline, diesel and fuel. Then coal-rich countries such as the U.S., China and Germany could depend meagerly on imported oil. At the same time, acid-rain pollution would be less because the liquefaction strips coal of harmful Sulphur."

10.6 Nanotechnology in Present:

By 2025 Nanotechnology is expected to be a mature industry with countless mainstream products graph.





The possibilities seem ceaseless. In the field of Nano electronics and computer technology, nanotechnology will permit the construction of smaller circuits and computers. Smaller circuits will run faster which are responsible for greater computer speeds. Computers will have a much longer life due to new Nano materials. A laptop computer could therefore have its efficiency increased by millions living longer and working faster to give far better value for money.

Nanotechnology has significant impact on the environment and environmental energy. solar cell can become more efficient if we use Nano sized solar cells as they provide much of the energy needed around the world. It also increases the efficiency of the fuel cell and batteries. In the future, nanotechnology will be used to tackle environment problems. New green processing technology can be adapted to minimize the generation of undesirable by products.

In health care and medicinal biology, the Nano -sensors are being developed in the next 5 years and they will be used for fast and accurate diagnostics. Further ahead, nanotechnology will be used to build artificial muscle and 'lab on a chip' technology will develop more efficient drug discovery processes.

There are many other future applications of nanotechnology and more possibilities will come to light as it is developed more. Nanotechnology offers major opportunities for the UK economy and it is key by which any country can make its base excellence in science and technology. Critics of nanotechnology insist that a strict regulatory system should be introduced to ensure risks are minimized and it is the responsibility of government to ensure that procedures are seriously adapted or not. if not then proper action should be taken by government.

Further in the future Nanotechnology will play a major role in medicine and longevity blood cell sized devices will go directly into human body, eradicating pathogens virtual reality and many other advanced treatments will become possible through the use of “Nanorods”.

In more distant future, Nanotechnology could allow humans to make the transition to fully non- biological forms. At atomic scale, entire body and brain could be reconstructed which leads to practical immortality.

10.7 Nanotechnology and Higher Education:

The Nanotechnology undergraduate education (NUE) in engineering program aims at introducing Nanoscale science engineering and technology through a variety of interdisciplinary approach into undergraduate engineering education. The focus of the program or Nanoscale engineering education with relevance to devices and systems and on the societal ethical and economic or environmental issues relevant to Nanotechnology.

The EMM- Nano program is truly integrated with a strong research backbone and on important international scope. The objective of the programme is to provide a top quality multidisciplinary education in Nano- Science & Nanotechnology.

The national institute for occupational safety and health has conducted initial research on how Nanoparticls interact with body's system and how workers might be exposed to Nano sized particles in the manufacturing or industrial use of Nanomaterials. The most instant challenge in nanotechnology is that we need to know more about materials and their properties at the nanoscale. Universities and corporations across the world are strictly studying how atoms combined together to form larger structures.

Education and training in nanotechnology is supported by the Commission through a system of Research Training Networks. New hybrid technologies, combining nanotechnologies, materials sciences, engineering, information technologies, biotechnology and environmental science, are developing those days.

This evolution requires such multidisciplinary networks over a wide range of research areas, as well as strong collaboration across traditional scientific borders between Nanotechnology researchers inside the European Union and worldwide.

- **Potential Risks:**

It can broadly be grouped into four areas-

a. Health issues
b. Environmental issues
c. Societal issues
d. Speculative issues

10.8 Conclusion:

Nanotechnologies may provide new solution for the millions of people in developing countries who lack access to basic services such as safe water, reliable energy, health care and education. The united nations have set millennium development goods for meeting these needs potential opportunities of Nanotechnologies to help address critical international development priorities include improved water purification system, energy system, medicine and pharmaceuticals, food production and nutrition and information and communication technology and all this will possible only when Nano science will become a part of higher education.

So that all student could know about Nanoparticles or Nanomaterials and show should start many program in the field of Nano Science in higher education that aims to enhance the quality of higher education in Nano science in order to promote India as a center of exallence in learning around the world.

As a result of nanotechnology Humanity will be faced with a powerful, accelerated social revolutions. In the future, a team of scientists will succeed in constructing the first Nano-sized robot which will be capable of self-replication. Consumer goods will become abundant, affordable, smart, and long lasting. Medicine will take a quantum leap forward. Travelling in space and colonization will become safe and economical. For these and other reasons global lifestyles will change radically and human behaviour drastically impacted.

This powerful combination of materials science and biotechnology will create entirely new processes and industries and put India among the world leaders thus leads to a Nano technological revolution. As the paper unveils the commercial application of nanotechnology, the consumer may appreciate the potential behind it. The decision of the consumer whether to accept it or reject it remains vital to the future of Nan technological industry and in pace with the world economy. Hence a clear perceptive will give clarity to the consumers to make the right decision in terms of accepting what technology that Nano offers.

- **Chemistry:**

Education in chemistry provides support for all teacher of chemistry across the secondary further and higher education sectors it aims to strength the community by providing high quality peer reviewed content tools and resources which promote the shearing of best practice and innovating teaching.

Chemistry education (or chemical education) is a comprehensive tern refers to the study of the teaching and learning of chemistry in all school. College and university. Topic in chemistry education might include understanding how student learn chemistry how best to teach chemistry and how to improve learning outcomes by changing teaching method and appropriate training of chemistry teacher, within many modes including classroom lecture demonstrations and laboratory activities. There is a constant need to update the skills of teacher engaged in teaching chemistry, and so chemistry education spears to this need.

- **Philosophical Prospective (How to Work in Chemistry):**

There are at least 4 different philosophical prospect-ive that describe how the work in Chemistry education is carried out. The first is what one might call a practitioner's perspective, where in the individuals who are responsible for teaching chemistry (teacher, instructor, professors) are ones who ultimately define chemistry education by their action.

A second prospective is define by a self-identify group of chemical educations, faculty members and instructors who, as opposed to declaring their pre interest in a typical area of laboratory research (organic, inorganic, bio- chemistry)

A third prospective is chemical education research (CER) tends to take the theories and method developed in pre-college. Science education research which generally take place in school of education and applies them to understanding comparable problems in post-secondary setting.

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