

NANO – TECHNOLOGY

Abstract

As a general-purpose technology, nanotechnology will continue to make significant economic inroads. Like earlier inventions like electricity or computers, it is likely to find extensive and far-reaching use in a variety of fields. For instance, nano- Electronics and nanomagnetism are opening the door to devices (such as logic transistors and memory devices) with feature sizes below 10 nm and are enabling a wide range of innovations, such as substituting electron charge as the only information carrier. Numerous other crucial industries will see evolutionary, incremental advancements based on nanotechnology, along with revolutionary, ground-breaking solutions that spur new product developments. On a direct level, nanoparticles are already extensively used in skin cosmetic formulations. Because they maintain the functionality of microparticles (such their ability to absorb light) and do not scatter light. The tools to study airborne particles are provided by nanotechnology itself, including atomic force microscopy to facilitate structural investigations and nanophotonics (integrated optics) to identify and measure them.

Keywords: Nanomagnetism, Microparticles, Nanophotonics, Nano electronics.

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I. INTRODUCTION

It is defined as the manipulating atoms and molecules at the nanoscale, which is defined as having one or more dimensions of the order of 100 nanometers (100 millionth of a millimeter) or less, structures, devices, and systems may be designed, produced, and used. This field of science and engineering is known as nanotechnology.

The capacity to accurately create materials at the nanoscale led the late Norio Taniguchi¹ (University of Tokyo) to coin the term “nanotechnology” in 1974. This is really its present definition; the term “engineer materials” is typically understood to include the design, characterization, manufacture, and application of materials. In addition to materials, the scope of the term has now been expanded to include devices and systems. Thus, the definition of nanotechnology is the controlled design and manufacture of materials, devices, and systems at the nanometer scale. Size and control are consequently at the core of nanotechnology. Some prefer the plural word “nanotechnologies” due to the variety of applications; yet, they all have the trait of control at the nanoscale.

II. WHAT BENEFITS DOES NANOTECHNOLOGY PROVIDE US ON RESEARCH BASIS?

Here, we tackle the issue of why nanotechnology is frequently described as revolutionary. Let’s think about the indirect, direct, and conceptual aspects. Indirect refers to the gradual downsizing of already existing technology, which creates new application domains for them. Direct refers to the use of brand-new, nanoengineered artifacts for entirely innovative applications or to improve the performance of currently used methods and materials. As in living systems, where complex molecules (like proteins) are disassembled into their component amino acids, which are then used for the templated synthesis of new proteins, the conceptual aspect of nanotechnology considers all materials and processes from a molecular or even atomic viewpoint. This Process’ artificial equivalent is yet mainly unexplored ground. Development of completely new integrated manufacturing life cycles is underway, with a focus on extreme energy efficiency and the lack of undesirable waste products. A new understanding of the world, its structures, and its processes is also possible from the conceptual nano-viewpoint.

By 2020, it is anticipated that nanotechnology will be widely used. Almost all industrial sectors and medical professions have the potential to use nanotechnology-enabled goods and services. Increased productivity, more sustainable development, and new jobs are all potential benefits.

III. NANO-CHEMISTRY AND IMMUNOLOGICAL ASPECTS OF NANOTECHNOLOGY

1. For the greatest social advantages, nanotechnology governance will be institutionalized in research, education, industry, and medical programs. Research techniques and equipment
2. The development of new theories on nanoscale complexity, techniques for direct measurements, simulations based on fundamental principles, and system integration at the nanoscale will speed up research.

3. Equipment for physical intervention and simulation A substantial portion of the transformation of biology into a quantitative “physico-chemical Science” rather than an empirical science will be completed by understanding cellular activities at the molecular level.
4. A thorough knowledge of the rules and procedures Competitiveness in fields including improved materials, information technology devices, catalysts, and pharmaceuticals will depend on the use of nanotechnology. The creation of precompetitive nanoscale scientific and engineering platforms will provide the groundwork for innovation across many industries.

IV. WHAT HAVE RECENT ADVANCES IN NANOTECHNOLOGY PRODUCED?

Electronics, photonics, medicines, cosmetics, and surface and fabric finishes make up the majority of current application fields.

The most common use of semiconductors’ ‘top down’ nanostructuring in the indirect sphere is the shrinking of circuits, which results in exponentially rising processing power. So every expression of computers’ rising role, from the Internet to mobile phones, is a byproduct of nanotechnology. Making micro electro-mechanical systems (MEMS), which include building three-dimensional mechanical structures in silicon that serve as accelerometers, torque sensors, pressure sensors, and other devices, is closely connected to making circuits. In this case, integrated optics opens the door to new types of sensors that outperform MEMS and electrochemical devices in precision, accuracy, and robustness. Top-down technique is now used to create these photonic devices.

Nanoparticles are already frequently employed in skin cosmetic compositions on a direct level. Because they do not scatter light and preserve the functionality of microparticles (such as the capacity to absorb UV light), active chemicals in the form of nanoparticles can be applied to the skin without altering its look. The disadvantage of minuteness is that the consequences are generally unknown since the particles almost effortlessly go through the skin and into the body.

Inspiring straight from nanoscopic investigations of “superhydrophobic” surfaces that are nanostructured Similar results can be achieved by applying the surfaces of “self-cleaning” leaves, such as those of the lotus, to fabrics, window glass, etc. Even the ranks of cravat and window cleaners have not yet seen any impact from just washing with water to remove dust and dirt particles off the surface. The glass cube or parallelepiped may yet remain popular among modern architects as a result of this particular use; hence, nanotechnology indirectly has a significant impact on the built environment.

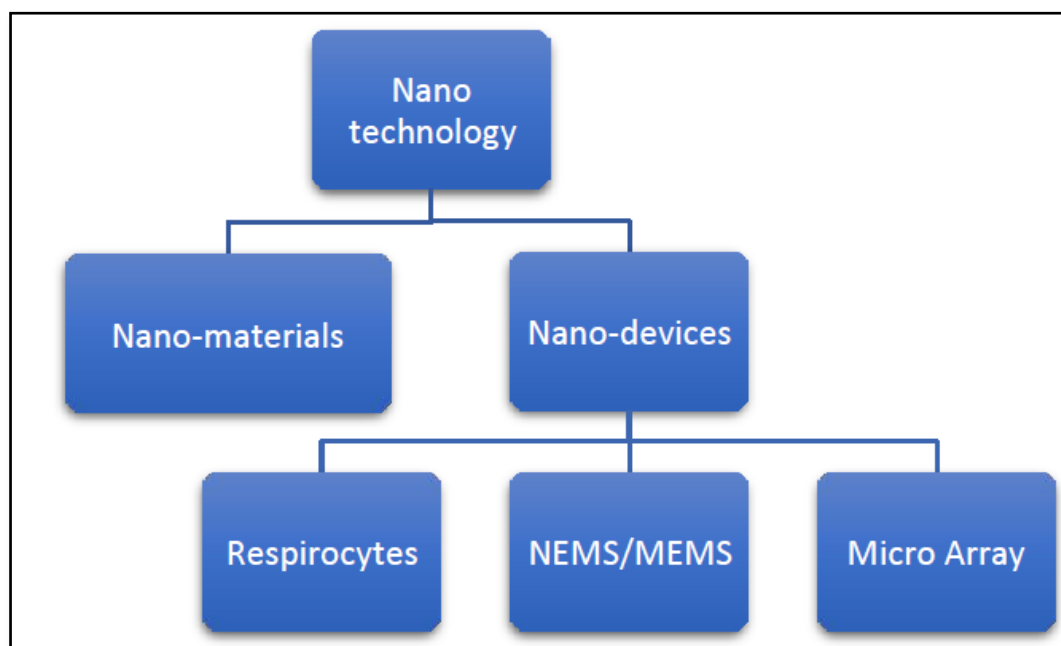


Figure 1: shows the devices and materials used in Nanotechnology

V. WHAT ARE THE KEY DIFFICULTIES THAT NANOTECHNOLOGISTS FACE?

- 1. Nanoparticle Security:** Nanoparticles can enter areas of the body that other forms of the same substance cannot because of their small size. Even cooking utensils are frequently composed of aluminum, which is not generally thought to be harmful. However, aluminum nanoparticles that are eaten through the digestive system, skin, or lungs are likely to be very toxic. Unless they are being employed as drugs, surprisingly little research has been done on the toxicity of nanoparticles and nanotubes. This is partially attributable to experience with smoke and other airborne nano- and microparticles. It is assumed that people can tolerate smoke from sources like cigarettes, garden fires, car exhaust, etc.

This assumption requires further investigation. While the chimneyless cottages that were typical in Russia two hundred years ago have mostly vanished, the prevalence of smoke in even modern living spaces has made society somewhat numb to its potentially harmful consequences. Nanotechnology itself provides the instruments to investigate airborne particles, including atomic force microscopy for supporting structural studies and nanophotonics (integrated optics) for their detection and quantification. Naturally, medical research will play a significant role in these investigations, which should have an impact on human cell ultrastructure and immune system impacts as well as help to unravel the mystery of allergies.

- 2. Public Acceptance:** Nanotechnologists are worried that the public would reject their work, as they have done with genetically modified food (GMF) crops. There are significant contrasts between the two realms, which should reassure them. GMF is a particularly specialized technology that directly affects people (where they are given to animals that are meant for human consumption). On the other hand, nanotechnology

encompasses a hugely varied range of activities, many of which have already been enthusiastically embraced—some might even say too enthusiastically—by the vast majority of the general population. The finest example is the cell phone.

The relentless march of nearly all technological branches toward downsizing implies that the rejection of nanotechnology will have an impact on virtually every item used in modern life at the start of the twenty-first century. For instance, a contemporary airplane features hundreds of onboard computers that were all constructed using top down nanotechnology, despite the fact that nanocomposites have not yet had a substantial impact on aircraft design.

Public worries about health risks are frequently unanticipated and driven more by trends than by a critical evaluation of the available information. If one disregards all the sources of nanoparticles, especially smokes, which have been around for decades, indirect effects of nanotechnology, like electromagnetic radiation from mobile phones, may very well be more harmful than direct effects, like inhaling nanoparticles. Because there is still much too little information, their evaluations sometimes have the air of guesswork, therefore what is required is not complacency but a rigorous study of all hazards.

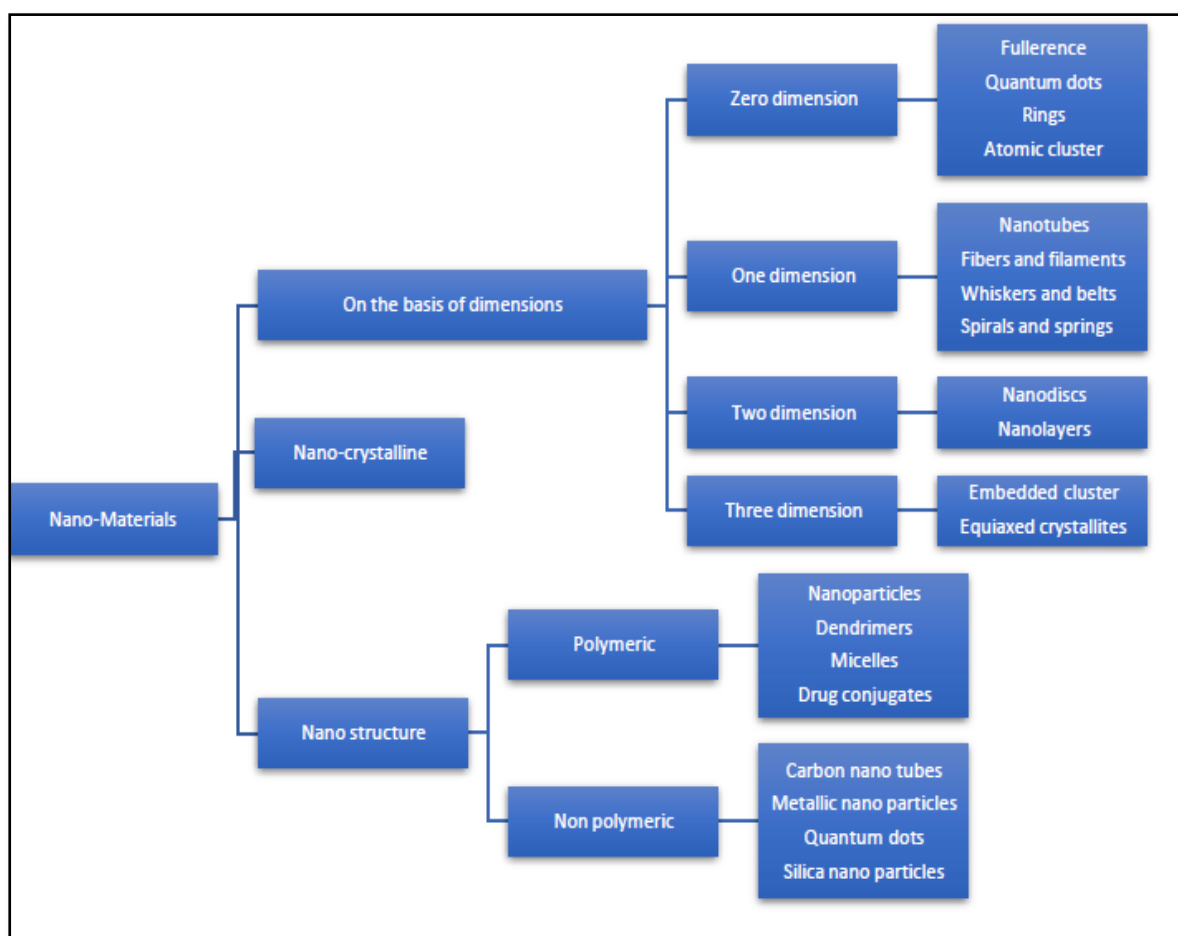


Figure 2: Shows the Different Materials Used in Nanotechnology

VI. APPLICATION

This categorization of nanomaterials is based on how many of a substance's dimensions are beyond the nanoscale (100 nm) range.

As a result, all of the dimensions of zero-dimensional (0D) nanomaterials are measured at the nanoscale (no dimension is bigger than 100 nm). 0D nanomaterials are typically nanoparticles.

One dimension is outside the nanoscale in one-dimensional nanomaterials (1D). Nanowires, nanorods, and nanotubes are all members of this class.

Two dimensions are outside the nanoscale in two-dimensional nanomaterials (2D). This class encompasses graphene, nanofilms, nanolayers, and nanocoatings and displays plate-like forms.

Materials that are not restricted to the nanoscale in any dimension are referred to as three-dimensional nanomaterials (3D). Bulk powders, nanoparticle dispersions, bundles of nanowires and nanotubes, as well as multi-nanolayers, can all be found in this class.

The applications that are the focus of this section are those that are still under investigation but have received enough weight to serve as proofs of concept. The two primary direct fields for which this seems to be the case are chemical synthesis and analysis and medicine.

1. The principal use of nanotechnology in the indirect domain is in materials, notably Nano composites. The idea that new combinations of characteristics may be created via anastomosis at the nanometre scale inspired their creation. Many prototype materials are now being researched—the aerospace industry is particularly interested in the use of ultralight and ultra strong composites for structural members, as well as ultrahigh Performance thermal barrier materials for turbine blade coatings—but the stringent safety requirements of most aerospace applications imply lengthy intervals of the order of a decade. Between laboratory tests and large-scale commercial applications. In the field of ultra precision machining, the next generation of ultra high performance telescopes with a spherically machined mirrors having a surface roughness of a few nanometers are expected to allow astronomy based on visible wavelengths to advance as never before, based on the construction of enormous terrestrial telescopes, and all that implies in terms of new Windows onto the universe, allowing fresh assessments of man and his relation to the cosmos.
2. The third anticipated use of nanotechnology In medicine is the development of Nano surgery, or microsurgery. Although complex surgeries still need to be performed in the conventional manner, microsurgical methods are very appealing due to the reduced invasiveness they imply. The pinnacle of nanotechnology is thought to be the creation of semi-autonomous robots that can be injected into the bloodstream and go to the area that needs repair work while doing the necessary maintenance. The “nanobot” might be controlled by external orders supplied by a surgeon if they include a camera. Tiny

cameras capable of traveling through the digestive system while recording images currently exist and are commercially accessible.

3. In order to determine whether a fully autonomous Device is possible, which could itself target the site requiring treatment and carry it out, it is also being examined whether such devices' potential algorithmic storage capacity could be a limiting factor rather than the miniaturization of surgical tools.

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