Nano-Technology

Animesh Jain[1],
[1]Student,
Department of Computer Science and Engineering,
Ganga institute of Technology And Management,
Kablana, Jhajjar, Haryana

Mahesh Kumar Malkani[2]
[2]Assistant Professor,
Department of Computer Science and Engineering
,Ganga institute of Technology And Management,
Kablana, Jhajjar, Haryana

Nanotechnology has been developed for being used in many fields of studies including physics, chemistry, biology, material science, engineering, and computer science. In this paper, we identify the nanotechnology development community and needs of nanotechnology in the field of computer science. This paper tells about the benefits of nanotechnology using nano tubes in place of silicon chip that is to be used in the CPU's of computer.

Keywords – Nanoscale, Nanometer, Structure, Molecular, Nanoscience.

I. INTRODUCTION

In 1959, Richard Feynman, a future Nobel Laureate, gave a visionary talk entitled "There's Plenty of Room at the Bottom on miniaturization to ***nanometer***-scales. Later, the work of Drexler also gave futuristic visions of nanotechnology. Feynman and Drexler's visions inspired many researchers in physics, material science, chemistry, biology and engineering to become nanotechnologists. Their visions were fundamental: since our ancestors made flint axes, we have been improving our technology to bring convenience into our everyday life. Today a computer can be carried with one hand – 40 years ago a computer (hundreds of times slower) was the size of a room. Miniaturization of microprocessors is currently in process at nanometer-scales. Nanotechnology are worldwide regarded as key technologies for innovation and technical progress in almost all branch of economy.

II. DEFINATIONOFNANOTECHNOLOGY

Up to now there is no internationally accepted definition of nanotechnologies. First approach are currently being worked out by the international standardization organization (ISO). Nanotechnologies describes creation, analysis and application of structures, molecular materials, in an interface and surface with at least one critical dimension or with manufacturing tolerances below 100 nanometers. [1]

Or

Building and using materials, devices and machines at the nanometer scale, making use of unique properties that occur for structures at those small dimensions.

In general, however, most agree that three things are important:

1. Small size, measured in 100s of nanometers or less
2. Unique properties because of the small size
3. Control the structure and composition on the nm scale in Order to control the properties.[2]

III. NANOSCALEMATERIALS

The materials that have different properties at the Nano scale level are called Nano scale materials. Some are better at conducting electricity or heat some are stronger, some have different magnetic properties, and some reflects light in a better way as their size changes. Nanoscale materials have far larger surface area then similar volume of much larger material.

A. *Nanoscalematerialsinnature*

Nature's secrets for building from the Nano scale create processes and machinery that scientist hope to imitate. Researchers already have copied the nanostructure of lotus leaf to create water repellent surface being use today to make stain proof cloths and other materials.

Others are trying to imitate the strength and flexibility of spider silk which is naturally reinforced by Nano scale crystal. Many important functions of leaving organisms take place at thenano scale. A typical protein such as hemoglobin which carries oxygen through the blood streams is 5 nanometers in diameter.

B. *Nanoscalematerialsmadebyhumans*

Now researchers have a much clearer picture of how to create nano scale materials with properties never envisioned before. Products using Nano scale material are now available. Antibacterial wound dressing use nano scale silver. A Nano scale dry powder can neutralize gas and liquid toxins in Chemical spills and elsewhere. [3]

IV. FUNDAMENTALCONCEPTSOF NANOTECHNOLOGY

A.Largetosmall:Materialistic

Several phenomena become pronounced as the size of the system decreases. These include statistical mechanical effects, as well as quantum mechanical effects, for example the "quantum size effect" where the electronic properties of solids are altered with great reductions in particle size. This effect does not come into play by going from macro to micro dimensions. However, quantum effects can become significant when the nanometer size range is reached, typically at distances of 100 nanometers or less, the so-called quantum realm. Additionally, a number of physical properties change when compared to macroscopic systems. One example is the increase in surface area to volume ratio altering mechanical, thermal and catalytic properties of materials. Diffusion and reactions at nanoscale, nanostructures materials and nanodevices with fast ion transport are generally referred to nanoionics. Mechanical properties of nanosystems are of interest in the nanomechanics research. The catalytic activity of nanomaterials also opens potential risks in their interaction withbiomaterials.Materials reduced to the nanoscale can show different properties compared to what they exhibit on a macro scale, enabling unique applications. For instance, opaque substances can become transparent (copper); stable materials can turn combustible (aluminum); insoluble materials may become soluble (gold). A material such as gold, which is chemically inert at normal scales, 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 nanoscale.

B. Simple To Complex: Molecular

Modern synthetic chemistry has reached the point where it is possible to prepare small molecules to almost any structure. These methods are used today to manufacture a wide variety of useful chemicals such as pharmaceuticals or commercial polymers. This ability raises the question of extending this kind of control to the next-larger level, seeking methods to assemble these single molecules into supramolecular assemblies consisting of many molecules arranged in a well-defined manner. These approaches utilize the concepts of molecular self-assembly and/orsupramolecular chemistry to automatically arrange themselves into some useful conformation through a bottom approach. The concept of molecular recognition is especially important: molecules can be designed so that a specific configuration or arrangement is favored due to noncovalentintermolecular forces. The Watson–Crick base pairing rules are a direct result of this, as is the specificity of an enzyme being targeted to a single substrate, or the specific folding of the protein itself. Thus, two or more components can be designed to be complementary and mutually attractive so that they make a more complex and useful whole.

Such bottom-up approaches should be capable of producing devices in parallel and be much cheaper than top-down methods, but could potentially be overwhelmed as the size and complexity of the desired assembly increases. Most useful structures require complex and thermodynamically unlikely arrangements of atoms. Nevertheless, there are many examples of self-assembly based on molecular recognition in biology, most notably Watson–Crick base pairing and enzyme-substrate interactions. The challenge for nanotechnology is whether these principles can be used to engineer new constructs in addition to natural ones. Heat transfer fluids serve an important role in efficient use of energy. The efficiency of a plant depends on the heat transfer fluid. Different types of fluid can be taken in account according to the collector type. It basically depends on the heating capacity of the collector. Depending on the technology, the working fluid is decided; for example demineralize water with an ethylene glycol mixture for operating temperatures less than 200°C, synthetic oil for temperatures up to 400°C or molten salt for higher temperatures.

So heat transfer fluid can be water, steam air, oil, molten salt.

C. Molecularnanotechnology: Alongterm View

Molecular nanotechnology, sometimes called molecular manufacturing, describes engineered nanosystems (nanoscale machines) operating on the molecular scale. Molecular nanotechnology is especially associated with the molecular assembler, a machine that can produce a desired structure or device atom-by-atom using the principles of mechanosynthesis. Manufacturing in the context of productive nanosystemsis not related to, and should be clearly distinguished from, the conventional technologies used to manufacture nanomaterials such as carbon nanotubes and nanoparticles.

When the term "nanotechnology" was independently coined and popularized by Eric Drexler (who at the time was unaware of an earlier usage by Norio Taniguchi) it referred to a future manufacturing technology based on molecular machine systems. The premise was that molecular scale biological analogies of traditional machine components demonstrated molecular machines were possible: by the countless examples found in biology, it is known that sophisticated, stochastically optimized biological machines can be produced. [4]

V. APPLICATIONS

As of August 21, 2008, the Project on Emerging Nanotechnologies estimates than over 800 manufacturer identified nanotech products are publicly available, with new ones hitting the market at a pace of 3–4 per week. The project lists all of the products in a publicly accessible online database. Most applications are limited to the use of "first generation" passive nano materials which includes titanium dioxide in sunscreen, cosmetics, surface coatings, and some food products; Carbon allotropes used to produce gecko tape; silver in food packaging, clothing, disinfectants and household appliances; zinc oxide in sunscreens and cosmetics, surface coatings, paints and outdoor furniture varnishes; and cerium oxide as a fuel catalyst.

Further applications allow tennis balls to last longer, golf balls to fly straighter, and even bowling balls to become more durable and have a harder surface. Trousers and socks have been infused with nanotechnology so that they will last longer and keep people cool in the summer. Bandages are being infused with silver nanoparticles to heal cuts faster. Cars are being manufactured with nanomaterials so they may need fewer metals and less fuel to operate in the future. Video game consoles and personal computers may become cheaper, faster, and contain more memory thanks to nanotechnology. Nanotechnology may have the ability to make existing medical applications cheaper and easier to use in places like the general practitioner's office and at home.

The National Science Foundation (a major distributor for nanotechnology research in the United States) funded researcher David Berube to study the field of nanotechnology. His findings are published in the monograph Nano-Hype: The Truth behind the Nanotechnology Buzz. This study concludes that much of what is sold as Nanotechnology in Computers 1599 "nanotechnology" is in fact a recasting of straightforward materials science, which is leading to a "nanotech industry built solely on selling nanotubes, nanowires, and the like" which will "end up with a few suppliers selling low margin products in huge volumes. "Further applications which require actual manipulation or arrangement of nanoscale components await further research. Though technologies branded with the term 'nano' are sometimes little related to and fall far short of the most ambitious and transformative technological goals of the sort in molecular manufacturing proposals, the term still connotes such ideas. To date, nanotechnology has been developed mostly from the basis in physics, chemistry, material science and biology. As nanotechnology is a truly multi-disciplinary field, the cooperation between researchers in all related areas is crucial to the success of nanotechnology. Until now, computer science has taken a role mostly in research tools, for example: a virtual reality system coupled to scanning probe devices in nano manipulator project.

However, according to M. C. Roco, the third and fourth generation of nanotechnology would rely heavily on research in computer science. In academic centers and government labs, nanotech is fostering new conversations. At Stanford, Duke and many other schools, the new nanotech buildings are physically located at the symbolic hub of the schools of engineering, computer science and medicine.

VI. ADVANTAGES

Nanotechnology is helping to considerably improve, even revolutionize, many technology and industry sectors: information technology, energy, environmental science, medicine, homeland security, food safety, and transportation, among many others. Nanoscale transistors that are faster, more powerful, and increasingly energy efficient; soon your computer's entire memory may be stored on a single tiny chip.

Magnetic random access memory (MRAM) enabled by nanometer- scale magnetic tunnel junctions that can quickly and effectively save even encrypted data during a system shutdown or crash, enable resume- play features, and gather vehicle accident data.

Displays for many new TVs, laptop computers, cell phones, digital cameras, and other devices incorporate nano structured polymer films known as organic light emitting diodes, or OLEDs. OLED screens offer brighter images in a flat format, as well as wider viewing angles, lighter weight, better picture density, lower power consumption, and longer lifetimes.

Other computing and electronic products include Flash memory chips for iPod Nanos; ultra-responsive hearing aids; antimicrobial/antibacterial coatings on Mouse/keyboard/cell phone casings; conductive inks for printed electronics for

RFID/smart cards/smart packaging; more life-like video games; and flexible displays for e-book readers.

Nanotechnology is improving the efficiency of fuel production from normal and low-grade raw petroleum materials through better catalysis, as well as fuel consumption efficiency in vehicles and power plants. Researchers are developing wires containing carbon nano tubes to have much lower resistance than the high-tension wires currently used in the electric grid and thus reduce transmission power loss.

- Nanotechnology manufacturing has a promise of producing new materials a hundred times stronger than steel, and more efficient and cheaper to produce as compared to the existing production techniques.
- Molecular manufacturing would greatly reduce water requirements, and also cheaply run greenhouses would be a means of saving water, land, and food.
- The efficient and inexpensive generation of electricity, using solar and thermal power, will make electric power available to basically everyone in the world.
- Faster, cheaper, and more powerful computers will be available that could help improve information and communication systems even in the remotest areas.
- Manufacturing of new technologies will be self-contained and clean, and will have less of an environmental impact.
- Cheap and advanced equipment for medical research and health care will make improved medicine widely available. It will be feasible to restore human organ engineered tissue while simple products will greatly reduce infectious diseases prevailing in many parts of the world.
- Nanotechnology will enhance capabilities in space ventures and operations. [5]

VII. CAREERAREAS

Career areas as diverse as designing medical diagnostic devices to building better batteries, creating cosmetics, enhancing energy-efficient windows, auto and plane manufacturing, or researching the nature of matter itself will all depend upon knowledge of nanoscale science and technology. Current applications of nanoscale science and technology, with corresponding career opportunities, exist in areas such as:

Nanoscale science and technology are fueling a revolution in manufacturing and production, creating new materials and novel processes. Not only will the areas listed above continue to grow and benefit from nanotechnology, but the following fields are expected to undergo explosive developments:

- Medicine: diagnostics and therapeutics (e.g., drug delivery)
- Energy: capture, storage, & use; fuel cells, batteries
- Environmental remediation: in conjunction with GM microbes
- Robotics: many uses

• Manufacturing: self-assembly; “bottom-up” fabrication of novel materials
• Commerce: Radio Frequency Identification (RFID) “smart”
Tags
• Space exploration: space elevator

As these lists of Nano science-based applications indicate, our world is increasingly dependent on science for food, shelter, energy, etc. For our democratic society to function effectively, citizens must become familiar with at least some basic science and, perhaps even more importantly, with Thinking scientifically.[6]

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