Journal of Advances and Scholarly Researches in Allied Education
Vol. 16, Issue No. 5, April-2019, ISSN 2230-7540

Ethics of Nanotechnology: Future Emerging Techniques

Renu Singla*

Department of Physics, Kurukshetra University, Kurukshetra, India

Abstract – The emerging field of nanoscience and nanotechnology are becoming more and more popular nowdays. Nanotechnology involves manipulating and controlling atoms and molecules and design new materials, nanomachines and nanodevices for application in all aspects of our lives. The application of nanotechnology has enormous potiential to greatly influences the world in which we live. From consumer goods ,electronics, computers, information and biotechnology, energy, environment and medicine, all sectors of economy are impacted by nanotechnology.

Keywords:- Nanotechnology, Nanoscience, Nanoscale, Atoms

----------X----------

INTRODUCTION

Nanotechnology is science of small things .It may be defined as study and investigation of material at small dimension. It is area of science and technology where small- small structures play a important role. The nanotechnology occurs at order of nanometes i.e 10-9m or one billionth of meter which is thousandth of millionth of meter.

Nanoscience and nanotechnology refers to control and manipulation of matter at nanometer dimensions. since all manufactured products are made from atoms, so the properties of these products depends on how these atoms are arranged. For example, if we rearrange carbon atoms in diamond we can get coal and again if we rearrange atoms in coal we get diamond or other thing else. Scientists have discovered the materials at small dimension- small particles, thin flims etc- can have significant different properties than same material at large scale .Thus at atomic and molecular level properties of materials behave differently than bulk levels. For example gold which is in yellow colors at bulk level is not longer remain same at nanoscale. Nanoscale dold particle can appear red or purple. This is because at nanoscale , motion of gold electron is confined. So electron of gold react differently with light compared to bulk scale gold particle.

The word ‘nano’ has been derived from Greek word ‘nanos’ that means “dwarf”. It refers to very small unit of length measurement corresponding to molecular scale.

To get a sense of nanoscale , take a example of cubic micron of water contains 90 billion atoms. A micron is one thousandth of millimeter and thousand times larger than.

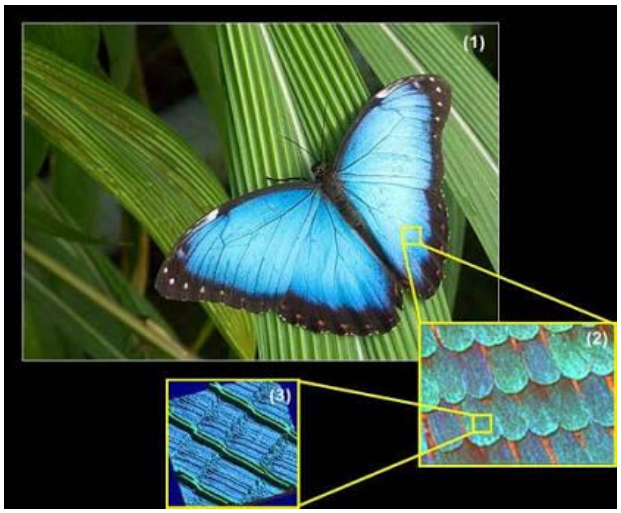
HISTORY OF NANOTECHNOLOGY

The term nanotechnology may be new development in scientific research but concepts has been used sincaterials have billions of years as natural phenomena. The study of biological systems and engineering of many material have been in nanometer regime for centuries.For example Chinese are known to use gold nanoparticle as an inorganic dye to introduce red colour into their ceramic porcelains more than thousand years ago. But term nanotechnology was first introduced by Norio Taniguhi though it was not widely known. In 1974 taniguchi was associated with manufacturing material with nanometer tolerences.but concepts initiated through a talk delivered by nobel prize winner Richard Faymann,a theoretical physictsts entitled”there is plenty of rooms at the bottom” in annual general body meeting American physical society at California institute of technology.His talk was later published in 1960 though he never used the word nanotechnology . In 1977 Drelexer originates molecules nanotechnology concepts at MIT.The emergence of nanotechnology in 1980 was caused by convergence of experimental advances such as invention of scanning tunneling microscope,an instrument for imaging surfaces at the atomic level by Gerd Binning & Heirrich Rohrer and the discovery of fullerenes in 1985 by Harry Kroto,Richard Smalley and Robort Curl.Scientists realized the importances of these discoveries and

declared that a new revolution is imminent with the term nanotechnology

NANOSCALE IN NATURE

If we look closely,we can notice that many plants and animals around us have developed special features that are at the nanoscale level. Let's examine some of the ways in which nature has used nanostructures.



A moth's eye has very small bumps on its surface. They have a hexagonal shape and are a few hundred nanometers tall and apart. Because these patterns are smaller than than the wavelength of visible light (350-800nm), the eye surface has a very low reflectance for the visible light so the moth's eye can absorb more light. The moth can see much better than humans in dim or dark conditions because these nanostructures absorb light very efficiently. In the lab, scientists have used similar man made nanostructures to enhance the absorption of infra-red light (heat) in a type of power source (a thermo-voltaic cell) to make them more efficient!

On the surface of a butterfly's wings arel multilayer nanoscale patterns. These structures filter light and reflect mostly one wavelength, so we see a single bright color. For instance the wings of the male Morpho Rhetenor appear bright blue. But the wing material is not, in fact, blue; it just appears blue becauce of particular nanostructures on the surface. More precisely, the nanostructures on butterfly's wings are about the same size as the wavelength of visible light and because of the multiple layers in these structures optical interferences are created. There is contrtructive interference for a given wavelength (around 450nm for the morepho Rhetenor) and destructive interferences for the other wavelengths, so we see a very bright blue color.In the laboratory, many scientific instruments use this same phenomena to analyze the color of light. Nanoscopic bumps on a lotus leaf transform its waxy surface into an extremely water repellent material. Raindrods roll easily across such a surface removing any accumulated dirt on leaf , making self cleansing possible. This is reasons why lotus leaves always shine though lotus stands in muddy water.

VISION AND OBJECTIVE OF NANO TECHNOLOGY

One of basic principles of nanotechnology is positional control i.e rearranging atoms whichever way we want. At nanoscale , the idea of holding and positioning atoms is new and almost shocking.However credit goes to vision of noble prize winning physicist, Richard Feyman, who in 1959, said that nothing in laws of physics prevented us from arranging atoms the way we want."…. it is something in principle that can be done ; but in practice , it has not been done because we

Objective -: nanotechnology will increase our standard of living.It will make our lives more secure , improve healthcare delivery and optimize our use of limited resources.

a) Security:

1. Imagine material ten times stronger than steel at a fraction of weight. With such materials, nanotechnology could revolutionize tanks, airframes, spacecraft, bridges and body armor providing unprecedented protection.

2. More powerful and smaller computers will encrypt our data and provide round the clock security.

3. Chemical sensors based on nanotechnology will be incredibly sensitive. Such sensors will be capable of pinpointing a single molecular out of billions. These sensors will be cheap and disposable, forewarning us of airport security breaches or anthrax laced letter.

b) Healthcare:

1. Hospital will benefit greatly from nanotechnology with faster, cheaper diagnostic equipments. Newborn children will have their DNA quickly mapped, pointing out future potiential problems ,allowing us to curtail disease before it takes hold

2. Nanotechnology will aid in delivery of just the right amount of medicine to exact spots of body that need it most.

c) Atoms computers: If the computer hardware revolution is to continue at its current peace, in a decade or so we will have to move beyond conventional lithography technique to new technology for manufacturing computers chips.

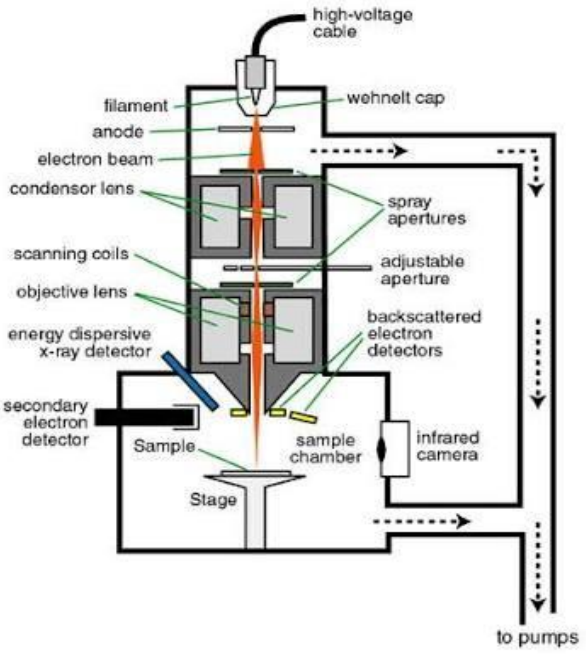
Ultimately, each logic elements will made from just a few atoms. Hence computer of future will use atoms instead of chips for memory.

d) Improved transportation: nanotechnology will provide lighter materials, which in turn will make air travel and space travel is more economical. Today, travel in space is very expensive and reserved for an elite few. Nanotechnology will dramatically reduce the costs and increase the capabilities of space ships and space flight.

VARIOUS TECHNIQUES INVOLVED IN NANOTECHNOLOGY

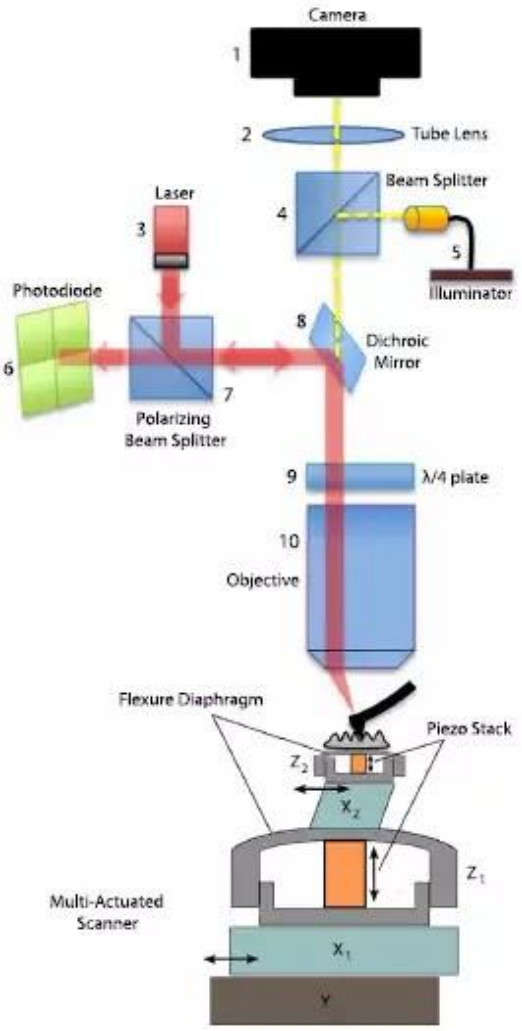
The most important aspects to make new discoveries is the observation and this is especially true at nanoscale .it is not possible to investigate about nano object without observing them. Science of measurement at nano scale level is known as nano metrology.this technique has made possible to study the structure as small as of order 1-2 angstrom by using ultra thin samples with the help of incident high energy electrons. Over the period of seventh years , various techniques for measurement at nano scale have been developed. Most of these were developed by keeping in mind certain physical phenomenon exhibited by objects at the nanoscale .Most important are follows:

SEM:-Produce high resolution image of surface of given sample , depending upon the manner in which image is created and it produces 3-d appearance .It creates image of invisible tiny objects by bombarding them with stream of electrons.

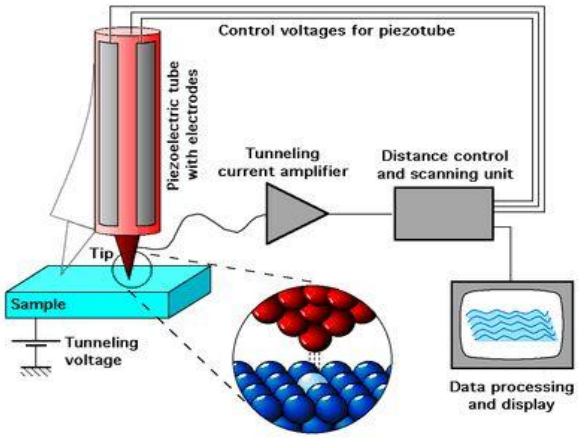


TEM:-TEM uses electrons as" light source". The electron's wavelength is so small due to which it gives resolution a thousand times better than with a light microscope. The electrons are made to fall on specimen in term of ultra-thin film.

AFM:- it is used to measure surface topography on a scale from angstrom to microns. This technique involves imaging a sample through the use of a probe or tip with a radius of 20nm.



STM:- is an instrument for imaging surface at atomic level. It is used to see the individual atoms on surface of sample in 3D.It can be used not only in ultrahigh vaccum but also in air, water and various other liquids and it is used to study things such as conductive materials and even DNA molecules.



CONCLUSIONS

To summarize in this chapter we have presented world of nanotechnology. This is world in which we play with atoms and design new materials like nanomachine, nanodevices which have various applications in all fields.

REFERENCES:

1. S.K. Goel, A. Narula, A. Garg, D. Singh (2016). Atomic, Molecular, Solid State and Nano Physics, Jeevansons publication, 3rd ed. ISBN: 978-93-86376-04-6.

2. A. Sharma, D. Sharma (2017). Solid State Physics and Nanophysics 2nd ed. Modern Publication. ISBN: 97789383907991.

Corresponding Author

Renu Singla*

Department of Physics, Kurukshetra University, Kurukshetra, India

renusdft@gmail.com