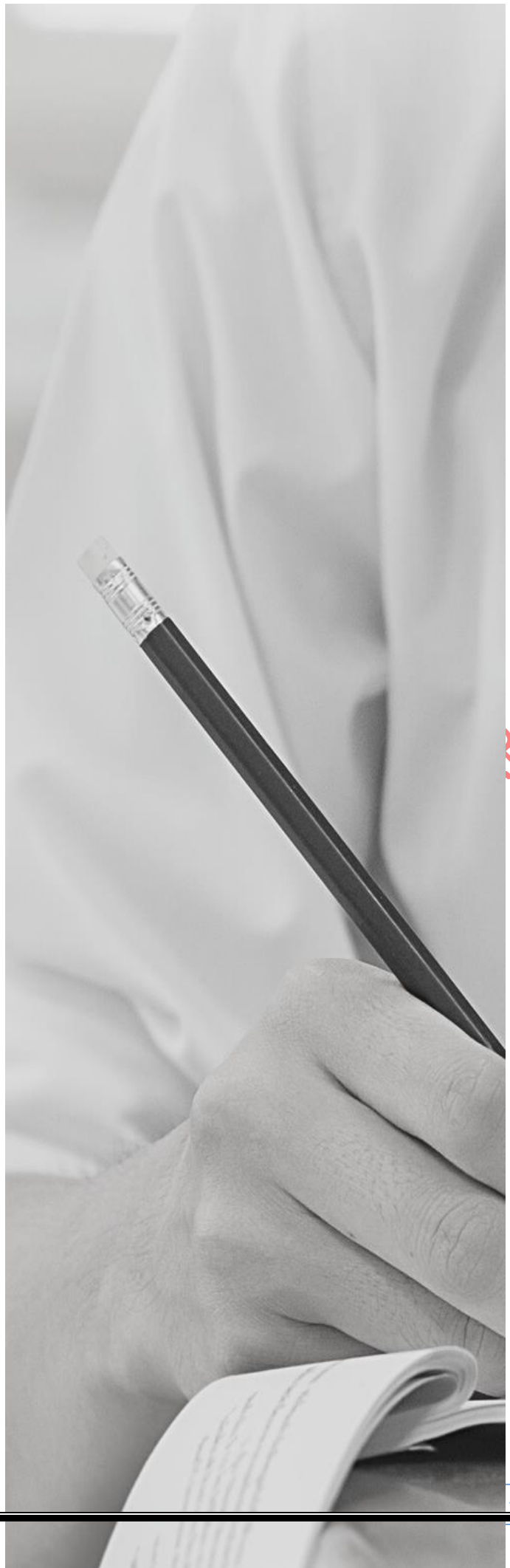

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Subject name: Special Material..

Subject year:2025\ 2 \10

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Lect.1.

What is Nano

Nano(symbol)is (n) is a unit prefix meaning one billionth.

Used primarily with the metric system, this prefix denotes a factor of (10^{-9} or 0.000000001).

It is frequently encountered in science and electronics for prefixing units of time and length.

Defined Nano

The origin of the word Nano is derived from the Greek word (Nanos).

which means dwarf and means every small thing, and here it means nanotechnology, microscopic technology, or miniature technology.

Because of their very small size, nanoparticles can penetrate very easily through the skin, lungs, and intestinal systems of humans without knowing their impact on human health.

Some experiments have indicated that nanoparticles, when inhaled, can cause inflammation in the lungs more than large-sized particles do, Of the same type.

Lect.1.

What is Nanotechnology

Nanotechnology is the science and engineering of small things, in particular things that are less than 100 nanometers in size (in one direction).

Nano is an SI prefix and comes from the Greek word for dwarf - Nanos.

One nanometer is 10^{-9} meters or about 3 atoms long.

At first, it can be hard to comprehend the Nano scale because it is so much smaller than our everyday experience.

While we know intuitively that a dime is smaller than a basketball, and even that a red blood cell (which can be observed in the light microscope) is smaller than a marble, we have no experience with objects that are billionths (10^{-9}) of a meter (1 nanometer or nm) in length.

When was the last time you put your hands around a strand of DNA (2.5 nm) or measured the diameter of a flu virus (100 nm), Here are a few comparisons to help understand how small a nanometer is:

1-An average human hair is about 60,000 -100,000 nanometers wide.

2- Your fingernail grows a nanometer every second .

3- A sheet of paper is about 100,000 nanometers thick.

4- In one inch there are 25,400,000 nanometers.

Lect.1.

Defined Nanomaterial's

Nanomaterial's (symbol)is (NMs) are defined as materials containing particles where one or more external dimensions are in the size range of (1–100nm).

What are nanomaterial's .

Nanomaterial's are usually considered to be materials with at least one external dimension that measures 100 nanometers or less or with internal structures measuring 100 nm or less.

They may be in the form of particles, tubes, rods or fibers.

The nanomaterial's that have the same composition as **known materials in bulk form may have different physic-chemical properties than the same materials in bulk form, and may behave differently if they enter the body.**

They may thus pose different potential hazards.

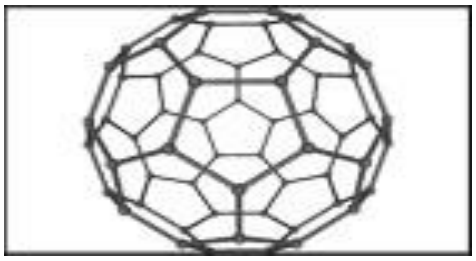


Fig (1) Nanomaterial's.

Lec.1.

Where are nanomaterial's found.

Some nanomaterial's can occur naturally, **such as blood borne proteins essential for life and lipids found in the blood and body fat.**

Scientists, however, are particularly interested in engineered nanomaterial's (ENMs), which are designed for use in many commercial materials, devices and structures. Already, thousands of common products including sunscreens, cosmetics, sporting goods, stain-resistant clothing, tires, and electronics—are manufactured using ENMs.

They are also in medical diagnosis, imaging and drug delivery and in environmental remediation.

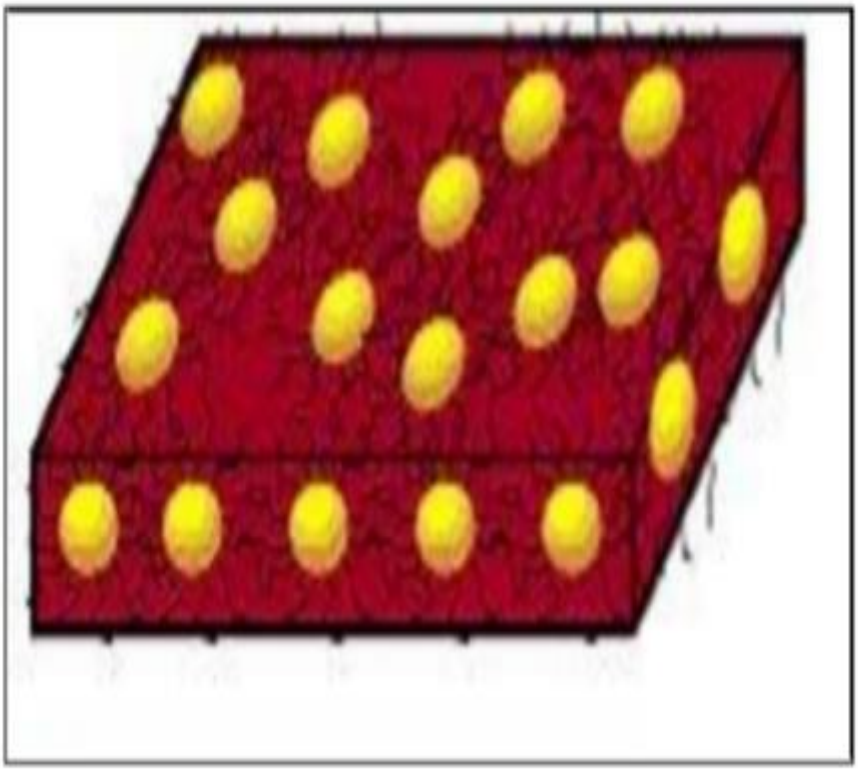
Fig(2). Nanomaterial's

Lect.1

Forms of nanomaterial's

1- Quantum Dots

Quantum dots are tiny particles or Nano crystals of a semiconducting material with diameters in the range of 2-10 nanometers (10-50 atoms).



Quantum Dots

Lect.1.

2-Fullerene

A nanostructure, which is a molecule composed of 60 carbon atoms and symbolized by the symbol C60.

The fullerene molecule is spherical in appearance and looks exactly like a football, containing 12 pentagons and 20 hexagons.

Since the discovery of how to manufacture fullerene in 1990, it has been prepared in commercial quantities.

It was also possible to obtain molecules with a different number of carbon atoms, such as C36, C48, and C70, but scientists showed special interest in the C60 molecule.

Fullerene.

Lect.1.

3-Nano balls

Carbon Nano spheres belong to the class of fullerenes, C60, but differ slightly from them in structure as they are multi-shelled.

They are also vacuolar, unlike nanoparticles, while there are no gaps on the surface as in multi-shell nanotubes.

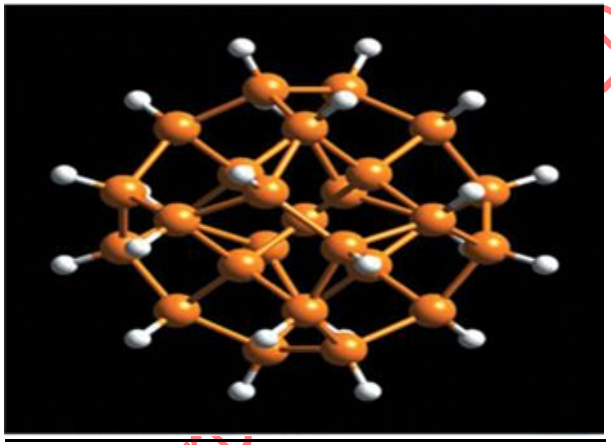
Because their structure resembles an onion, scientists called them (bucky onions), and the diameter of the Nano spheres may reach 500 nanometers or more.

Nano balls

Lect.1.

4-Nanoparticles

Nanoparticles are microscopic atomic or molecular aggregates ranging in number from a few atoms (molecule) to a million atoms, bound together in a roughly spherical shape with a radius of less than 100 nanometers.



Nanoparticles

Lect.1

5-Nanotubes

Nanotubes come in many shapes, they may be straight, spiral, curvy, bamboo, conical, etc.

These tubes also have unusual properties in terms of strength, hardness, electrical conductivity, etc.

Nano carbon also has other forms such as Nano spheres and nan fibers.

The wall of the tube is either single atoms, and in this case it is called a single wall nanotube (SWNT), or two or more, and it is called a multi-wall nanotube (MWNT), and the diameter of the tube ranges from less than one nanometer to 100 nanometers (smaller than the width of 50,000 times the length of a head hair), while its length may reach 100 micrometers to form a nanowire.

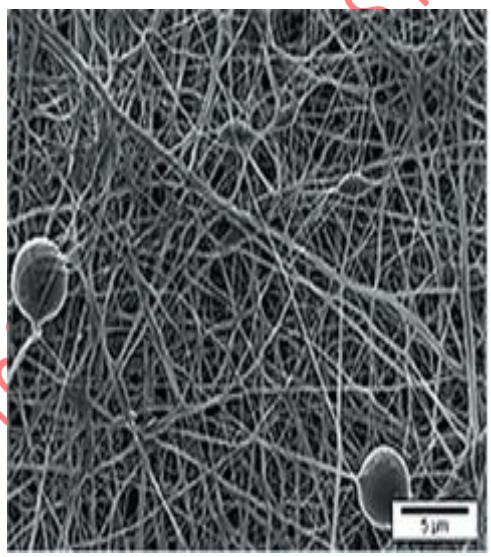
Nanotubes

Lect.1.

6-Nanofibres

Nano fibers come in many shapes, such as hexagonal, helical, and corn-shaped fibers. The side portion of a sheet or tubular Nano fiber has a hexagonal shape, for example, rather than a cylindrical shape.

The most famous Nano fibers are those made from polymer atoms. The ratio of surface area to volume is large in the case of Nano fibers, as well as nanotubes, as the number of surface atoms is large compared to the total number, and this gives these fibers distinctive mechanical properties such as hardness, tensile strength, etc.



Nano fibers.

Lect.1

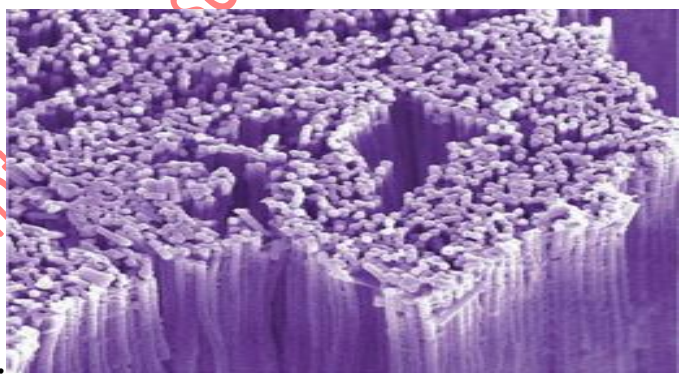
7-Nanowires

They are wires with a diameter of less than one nanometer and different lengths, that is, a length to width ratio of more than 1000 times, so they are attached to one-dimensiona

l materials, and as expected, they outperform traditional (three-dimensional).

wires Nanowires have many shapes, they may be spiral or symmetrical, pentagonal in shape. When prepared in the laboratory, nanowires may be in the form of wires hanging from their upper end or deposited on another surface.

One of the methods used to produce attached wires is to chemically abrade a large wire or bombard a large wire with high-energy particles.



Nanowires

.Lect.1.

The benefits of nanomedicine include:

Nanomedicine is a branch of medicine that utilizes nanotechnology for diagnosis, treatment, and prevention of diseases. Here are some key benefits of nanomedicine:

1-**geted Drug Delivery: Nanoparticles can be engineered to deliver drugs directly to specific cells or tissues, minimizing side effects and improving treatment efficacy.**

2-Early Diagnosis: Nanoscale materials can enhance imaging techniques, allowing for earlier and more accurate diagnosis of diseases, such as cancer.

3-Improved Treatment Methods: Nanotechnology can improve existing therapies, such as using nanoparticles to enhance the effectiveness of chemotherapy.

4-Regenerative Medicine: Nanomaterials can be used to create scaffolds for tissue engineering, promoting the regeneration of damaged tissues.

5-Vaccines and Immunotherapies: Nanoparticles can be used to develop more effective vaccines and immunotherapeutic agents by enhancing immune responses

6-Diagnostics: Nano sensors can detect diseases at very low concentrations, providing rapid and sensitive diagnostic capabilities.

7-Reduced Drug Resistance: By using Nano carriers, it may be possible to overcome drug resistance in certain diseases, particularly in cancer.