

Nanostructures- they are objects with nanometer scale. Individual nanostructures come in a range of different forms including:

- clusters, nanoparticles, nanocrystals, quantum dots, nanowires, nanotubes, nanofibres, nanodots, and aggregated dendritic forms which are often three dimensional spherical in shape.

-In general, 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.

Carbon nanoparticles

CNTs, most simply, are molecules of carbon. CNTs display extraordinary mechanical, electronic, and optical properties. *One of the key advantages of CNTs is their strength.

*CNTs are expected to have huge applications in nanometer-sized electronics, such as one-dimensional quantum wire, or to strengthen polymer materials.

Nanoclay

Nanoclay: a clay consisting of nano-sized particles. There are two origins of nanoclay, firstly, the in situ alteration of volcanic ash, and secondly the hydrothermal alteration of volcanic rocks.

- There is interest to use it in food packaging applications such as to make transparent containers and covering films.

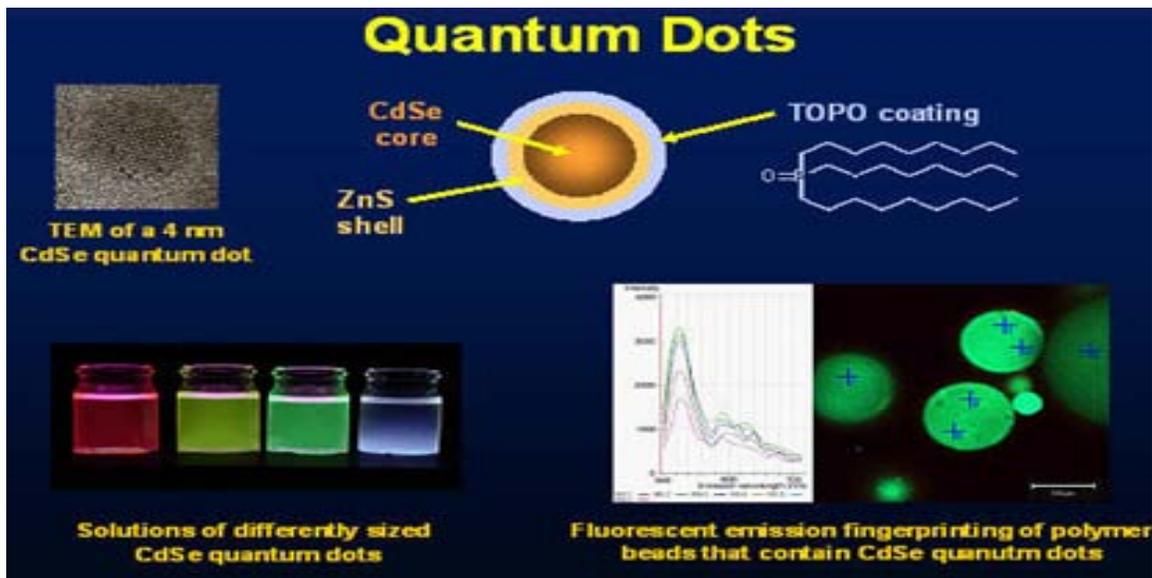
Types of nanoclay

The structure of the nanoclay particles can be divided into two main groups, platelets and halo site nanotubes.

Quantum Dots

Quantum dots are one of the most interesting nanotechnology developments.

-About 1 to 6 nanometers in diameter, a quantum dot is a nano-sized semiconductor crystal, and are so small that they are also known as artificial atoms. Quantum dots have a range of remarkable electrical, magnetic, optical, and catalytic properties.



-Quantum dots are spherical or cubic-like in shape and are made up of thousands of atoms. With highly luminous quantum dots, doctors are able to identify cancerous tissue in vivo by using a Mercury lamp. The quantum dots are attracted to cancerous tissue.

Nanocrystals

Nanocrystals are grown from inorganic materials. Atoms aggregate into a crystalline form which is known as a cluster. Usually, nanocrystals are grown from metals and semiconductors, however, they have been made from, gold, rhodium, platinum, palladium, and silver. Nanocrystals in diameter are roughly 10 nanometers.

-The most interesting application of nanocrystals may be in the development of solar cells.

Nanoshells

-Nanoshells consist of a silica core, with an ultrathin metallic coating. Nanoshells are ball shaped and about 5% the size of a red blood cell. The core of the nanoshell, which has a diameter of about 100 nm, is non-conducting , while the outer layering, usually gold or silver, approximately 8 to 10 nm is conducting.

Nanoshells can be created with all shapes, and sizes. It can look like rods, balls, or eggs. Non-toxic cancer treatment is the most exciting applications of nanoshells. nanoshells have been injected into the bodies of animals and then illuminated giving off intense heat destroying tumor cells. Scientists can create the optimal sized nanoshell to create the optimal heating which destroys the tumor but not healthy tissue nearby.

Nanowire

- A nanowire is simply a wire made of metal, silicon, or other conductor which is nano-sized. Nanowires are also known as quantum wires. Nanowires allow the creation of other nano-sized technologies such as nano-robots. Such nano-sized robots could be used in the medical diagnoses.

- Self assembly lipid microtube

- Glycerophosphatidylcholine it can self-assemble into a lipid microtubule structure. The lipid microtubule is a stable structure.

- Both lipid microtubules and metalized microtubules can be used as vehicles for encapsulating biological active molecules to control their release and to develop micro-components in biological and mechanical systems.

Gadira Rings

- Gadira Rings is designed with a pattern of diverse and novel of manufactured amino acids, which are equipped with chains amino acids bound to the outside rings. It works like sensors with the ability to respond to environmental stimuli.

- The control of the size and composition of sensors of specific chemical reactions leading to the production of many kinds and different Rings Gadira that fit the diversity of pathogenic bacteria, it is used as antibiotics.

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Peptide nanotubes

- Peptide nanotubes consist of cyclic peptide from an equal number of D-amino acid and L-amino acid. The inner diameter of the tube determines by the number of amino acids.
- Peptide nanotubes are used as a new type of antibiotics used to treat bacterial infections that resistant to conventional antibiotics. It is Called smart drugs. These cyclic peptides are called nanobiotics .

Magnetic nanoparticles

- Magnetic nanoparticles are a class of [nanoparticle](#) which can be manipulated using [magnetic field](#). Such particles commonly consist of magnetic elements such as [iron](#), [nickel](#) and [cobalt](#) and their [chemical compounds](#).
- In most cases, the particles range from 1 to 100 nm in size. A wide variety of applications have been envisaged for this class of particles these include:
 - Magnetic nanoparticles are used in an [experimental cancer treatment](#).
 - Another potential treatment of cancer includes attaching magnetic nanoparticles to free-floating cancer cells.

Application of magnetic nanoparticles

- ▣ Magnetic immunoassay
- ▣ drug targeting
- ▣ [biomedicine](#) & Biomedical imaging
- ▣ [environmental remediation](#)
- ▣ Waste water treatment
- ▣ Genetic engineering.

Inorganic Nanocages

- **Inorganic Nanocages** are hollow porous [gold nanoparticles](#) ranging in size from 10 to over 150 nm. Gold nanocages also absorb light and heat up, killing surrounding cancer [cells](#). functionalized nanocages with cancer-specific [antibodies](#) so they specifically attach to cancer cells.

Nanofoams

- Nanofoams of [iron](#), [cobalt](#), [nickel](#), [copper](#), [silver](#), and [palladium](#) have been prepared. These foams are effective catalysts and are being investigated for other applications.

Nanofibers

- **Nanofibers** are defined as [fibers](#) with diameters less than 100 nm. The most frequently mentioned materials with nanofiber [morphology](#) are: [titanium dioxide](#) (TiO₂), [silicon dioxide](#) (SiO₂), [aluminum oxide](#) (Al₂O₃), or [platinum](#) (Pt).
- **In Medical uses:** Artificial organ components, tissue engineering, drug delivery, wound dressing, medical textile materials.

Nanomesh

- The nanomesh is a new [inorganic](#) nanostructured two-dimensional material. It was discovered in 2003. The nanomesh looks like an assembly of hexagonal pores at the [nanometer](#) scale.
- The distance between 2 pore centers is only of 3.2 nm, whereas each pore has a diameter of about 2 nm and is 0.05 nm deep. interesting applications of the nanomesh in areas like [nanocatalysis](#), [surface functionalisation](#), etc.

Nanoflowers

- These crystalline nanostructures of silicon carbide are grown from droplets of gallium on a silicon surface.
- These nanoflowers will be used in new applications, such as water repellent coatings or new types of solar cells.