



SNS COLLEGE OF TECHNOLOGY

Vazhiampalayam, Coimbatore-35

(An Autonomous institution)

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Approved by **AICTE**, New Delhi & Affiliated to **Anna University**, Chennai

DEPARTMENT OF CHEMISTRY

COURSE NAME : 23CHT101- ENGINEERING CHEMISTRY

I YEAR / I SEMESTER

UNIT : 2. NANOMATERAILS

TOPIC : 5. CARBON NANOTUBES



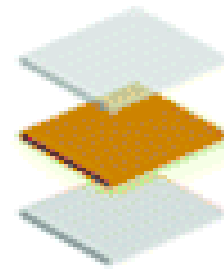


CLASSIFICATION OF NANOPARTICLES

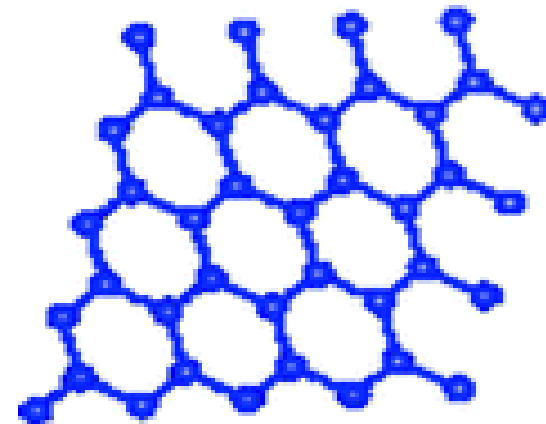


- Nano wires
- Nano rods
- Nano clusters
- Nano tubes

2D



**Nanosheets
Nanoplates**

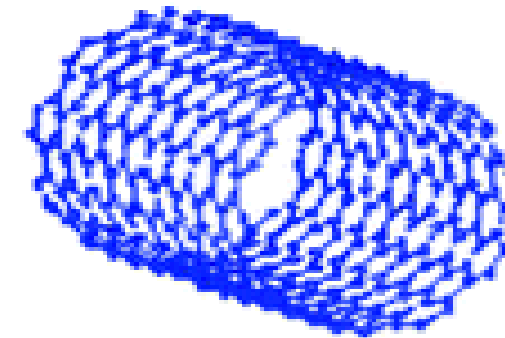


Graphene

1D

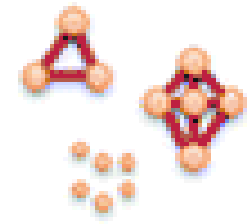


**Nanorods
Nanofibers
Nanotubes**

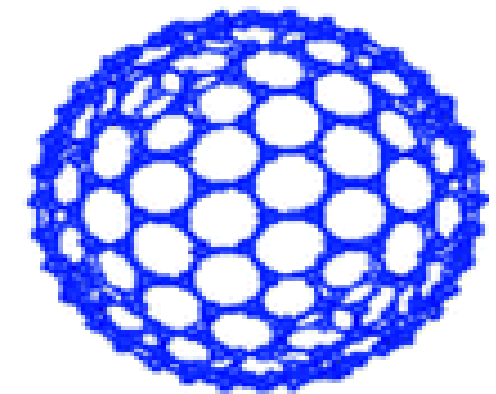


Nanotube

0D



**Spheres
Clusters**



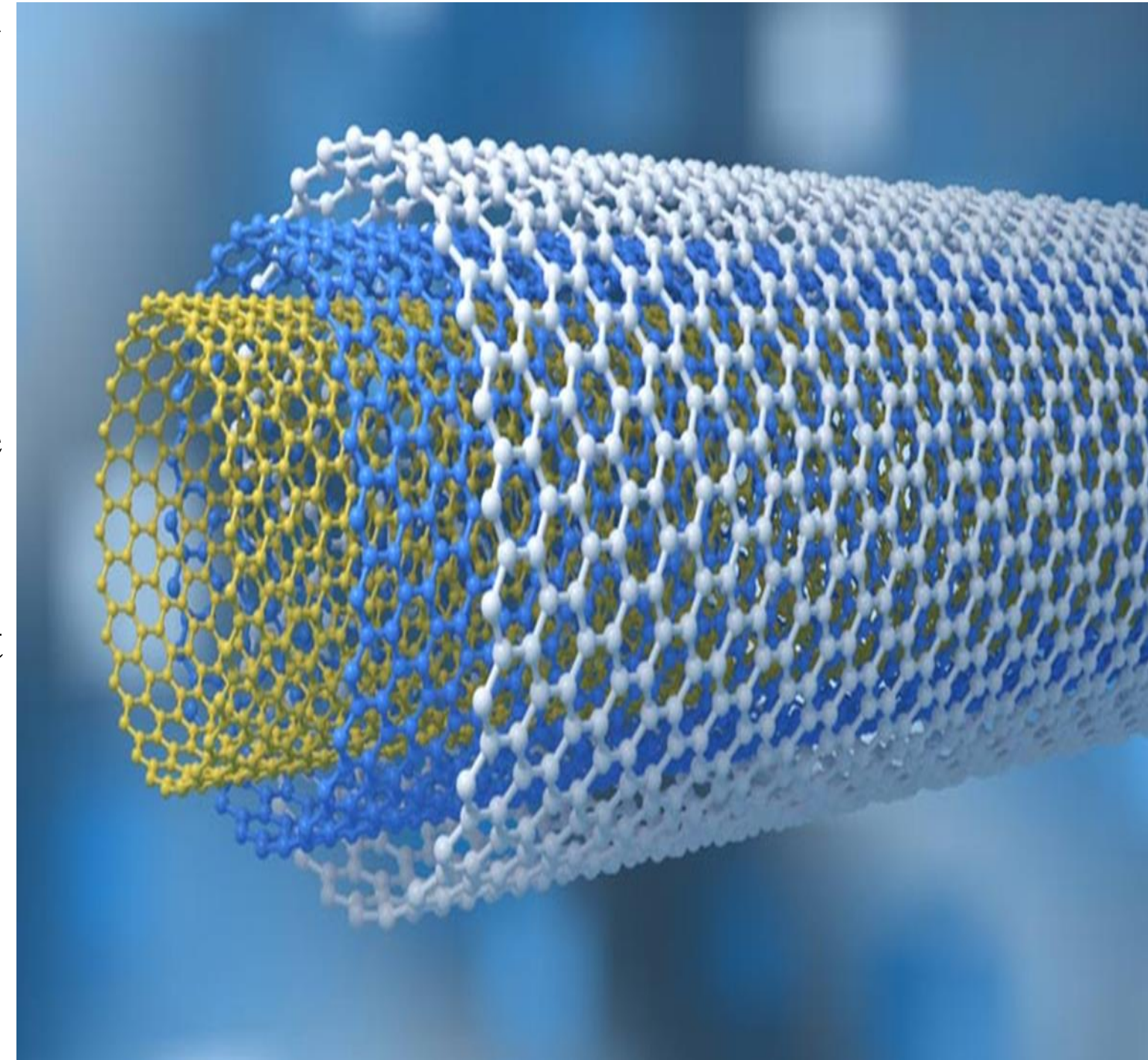
Fullerene



NANOTUBES



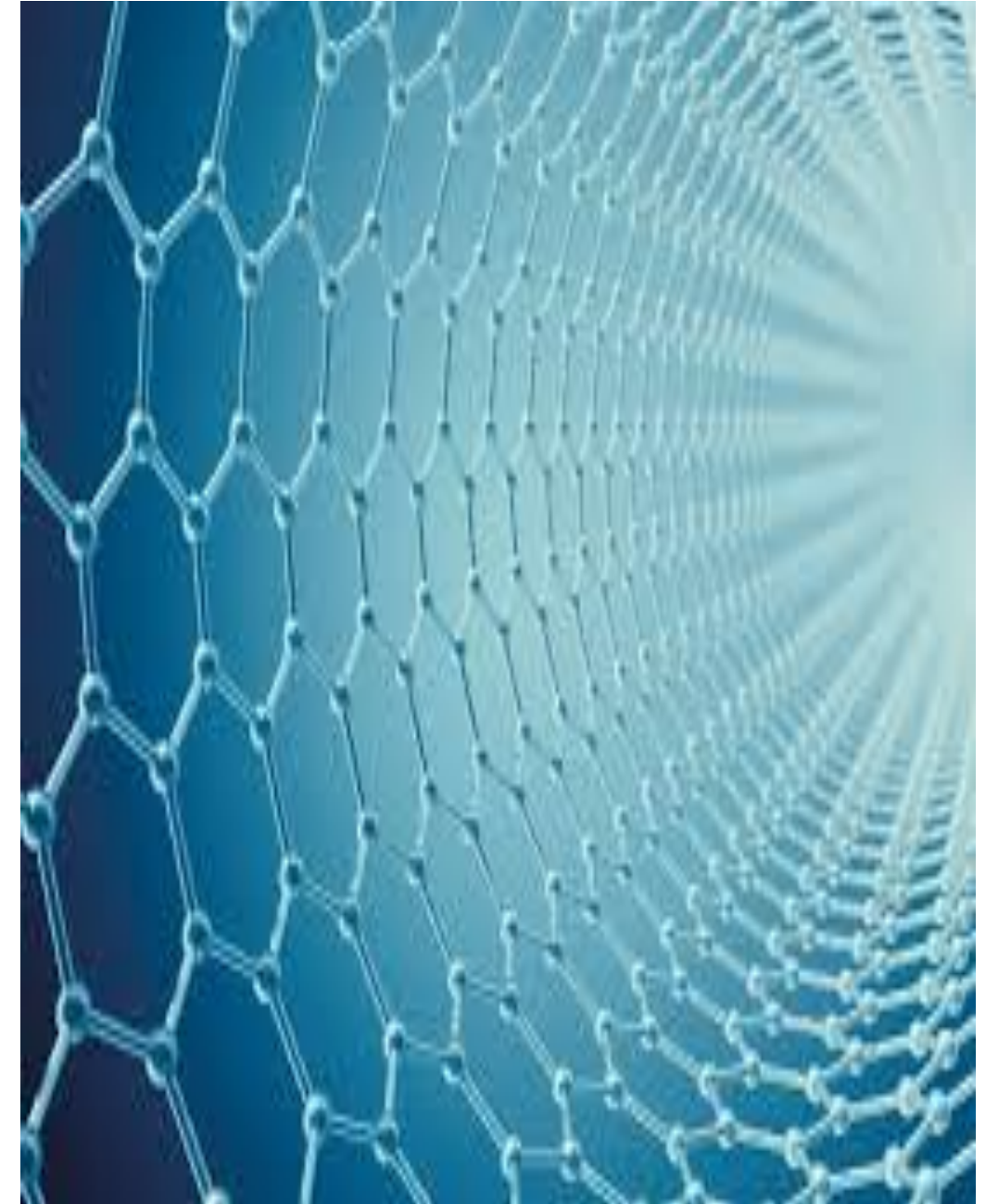
- Nano Tubes are tubular form of C with 1-3 nm dia & a length of few nm – Micron.
- Each C atoms are linked by covalent bond.
- **Carbon Nano Tube**
- A CNT is a cylindrical C structure that has hexagonal graphite molecules attached at the edges.
- It look like a powder or black soot, rolled-up sheets of graphene that form hollow strands with walls that are only one atom thick.
- Nanotubes, which are allotropic forms carbon like graphite, diamond, buckminster, fullerence & nanotubes





NANOTUBE

- They grown in a laboratory, are strong & exhibit many thermal and electrical properties that are desirable to chip makers.
- CNT have the potential to be used as semiconductors, for example, potentially replacing silicon in a wide variety of computing devices.
- Nanotubes can be characterized by their number of concentric cylinders, cylinder radius and cylinder length.
- Some nanotubes have a property called chirality, an expression of longitudinal twisting..

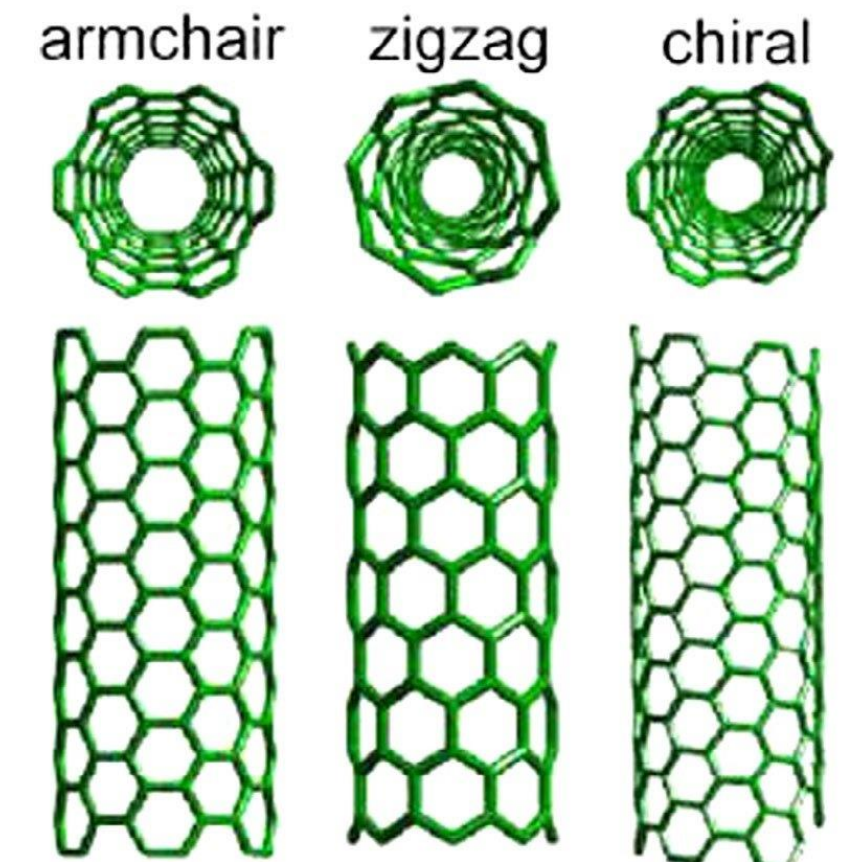
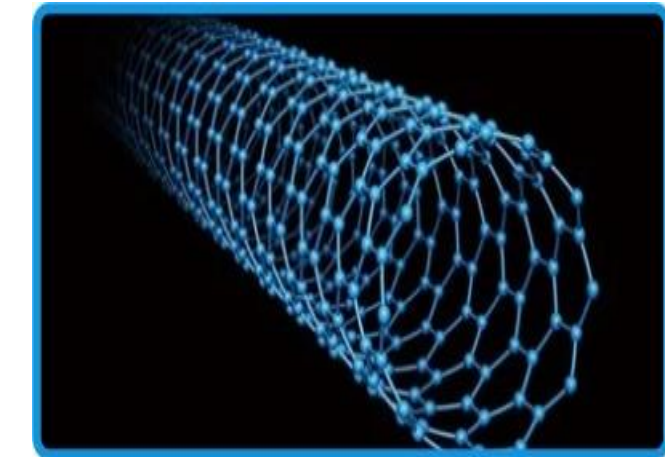




TYPES OF NANOTUBES

Types of CNT

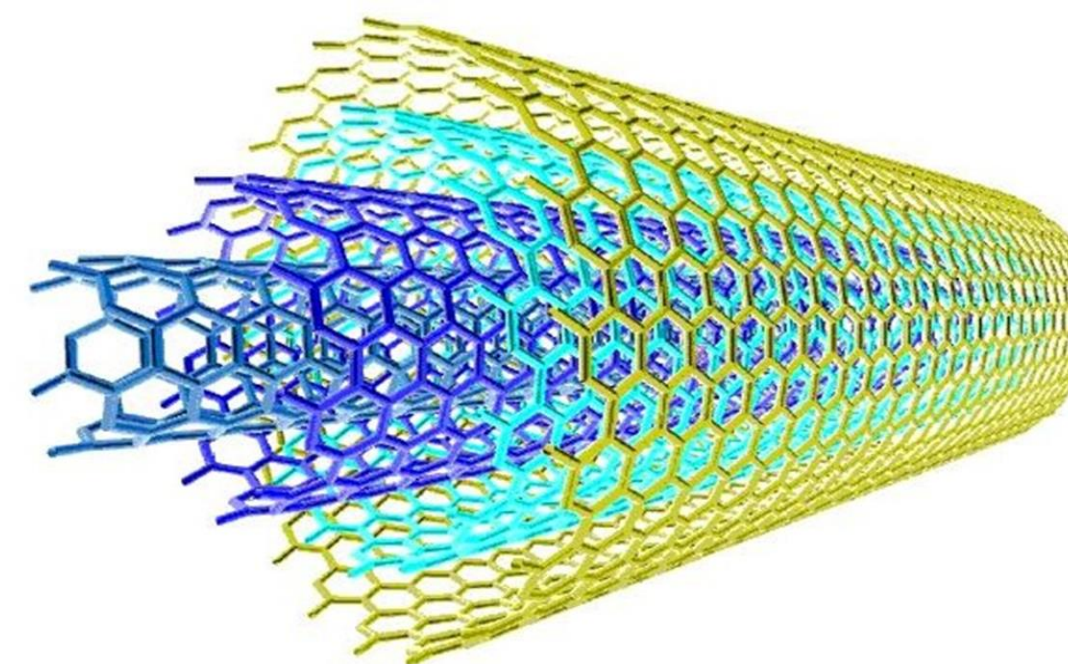
- Singled walled (SWCNT)
- Multi walled (MWCNT)
- SWCNT
- It consists 1 sheet of graphite cylinder, Exist in 1-D structure.
- Single-walled carbon nanotubes have a diameter and length of 2 nm and 2 micrometers, respectively.
- They have exceptional strength, and distinct electrical characteristics, and are effective heat conductors.
- Have a wide range of applications in the fields of materials science like as electronics, nanotechnology, and optic





TYPES OF NANOTUBES

- Multi walled (MWCNT)
- It consists of multilayer of graphite rolled themselves to form a tube shape
- Multi-walled Carbon Nanotubes have an outer diameter of 2–20 nm and an inner diameter of 1-3 nm, respectively.
- Multi-walled Carbon Nanotubes are about 5 to 6 micrometers in length.





PROPERTIES OF NANOTUBES

- Carbon nanotubes (CNTs) have high mechanical strength and are both electrically and thermally conductive.
- Carbon nanotubes are the stiffest and strongest materials discovered so far on basis of elastic modulus and tensile strength.
- They are stronger than steel and as rigid as a diamond.
- Carbon nanotubes have a very high melting point since each carbon atom is strongly covalently bound to three other carbon atoms.
- The carbon nanotubes' density is one-fourth that of steel.
- Regular hexagons make up the crystalline structure of carbon nanotubes.
- They are exceptionally resistant to corrosion as, like graphite, they are highly chemically stable and can withstand almost any chemical reaction unless they are subsequently exposed to high temperatures and oxygen.





APPLICATIONS OF NANOMATERIALS

- Carbon nanotubes are utilized in energy storage, device modelling, automotive parts, boat hulls, sporting goods, water filters, thin-film electronics, coatings, actuators, and electromagnetic shields.
- Because of their large surface area, CNTs have been successfully used in pharmacy and medicine to adsorb or conjugate a wide range of medicinal and diagnostic substances.
- CNTs have a number of unique chemical, size, optical, electrical, and structural properties that make them appealing as drug delivery and biosensing platforms for the treatment of a variety of diseases and noninvasive monitoring of blood levels and other chemical properties of the human body, respectively.
- Carbon nanotubes (CNTs) have unique qualities, such as high surface-to-volume ratios, increased conductivity and strength, biocompatibility, ease of functionalization, optical properties, and so on.



APPLICATIONS OF NANOTUBES



- Attractive characteristics of carbon nanotubes (CNTs) include their high surface-to-volume ratios, improved conductivity & strength, biocompatibility, simplicity of functionalization, optical features, and more CNTs have been employed successfully in pharmacy and healthcare to adsorb or synthesize a variety of therapeutic and diagnostic drugs attributed to their large surface area.
- Carbon nanotubes are used in thin-film electronics, actuators, coatings, water filters, automobile components, boat hulls, sporting goods, and electromagnetic shields.
- CNTs are attractive as drug delivery and biosensing operating systems due to their unique size, and chemical, optical, electrical, and structural properties, which have made them useful in the treatment of a wide range of diseases.
- The diameter of the carbon nanotubes can be employed to filter out particles that are too large to pass through. Smaller ions in a solution can also be captured using this method.



ASSESSMENT



1. List out any two applications of nanotubes.

2. Paste the image of carbon nanotube



SUMMARY



REFERENCES

1. Dr. V. Veeraiyan, "Engineering Chemistry-II" VRB Pub. Co. Ltd, Chennai. 2016..
2. Wiley, "Engineering Chemistry", John Wiley & Sons. InC, USA.
3. P.C. Jain & Monicka Jain, "Engineering Chemistry", Dhanapat Rai Publishing Company Pvt. Ltd. 2017.

THANK YOU