



# SNS COLLEGE OF ENGINEERING

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## AN AUTONOMOUS INSTITUTION



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

### Unit – V New Engineering Materials

#### Topic: 4 CNT Preparation - Pulsed Laser Deposition

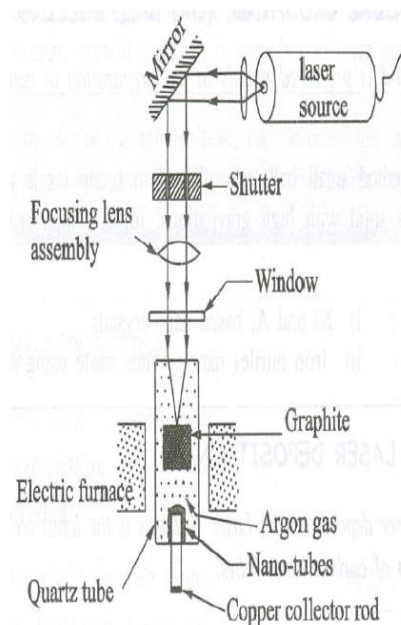
##### PULSED LASER DEPOSITION

Pulsed laser deposition is the latest technique adopted for the preparation of carbon nano tubes.

##### Principle

The technique of laser heat treatment is used in the preparation of carbon nano tubes. Ruby laser, Nd – YAG laser and CO<sub>2</sub> laser are used for this purpose.

##### Instrumentation



The Instrumentation for the fabrication of carbon nano tubes consists of a quartz tube containing a graphite target kept in argon gas region. The tube is surrounded by an electric furnace in order to heat the target. A colder copper collector rod is used to collect the nano carbons emitted by the graphite. Along with this it also consists of a pulsed laser source to

produce laser beam, shutter to control the intensity of the laser beam and an assembly of lenses to effectively focus the laser onto the graphite.

### **Synthesis**

Initially the graphite is heated upto 1200°C with the help of the electric furnace. An intense laser beam can be used to evaporate carbon from the graphite and thus now the laser source is switched ON. The light reflected by the plane mirror is made to pass through the shutter and hence the intensity is controlled. Then the beam is made to fall on the focussing lens assembly. This lens assembly focuses the light effectively onto the window and is made to incident on the graphite.

Due to laser heating the graphite gets heated and evaporates carbon atoms. The argon gas present inside the quartz tube is used to sweep the carbon atoms towards the colder copper collector rod. Thus, due to the movement of carbon atoms from a higher temperature to a lower temperature region it gets condensed and hence carbon nano tubes are formed over the collector rod. The cobalt and nickel present in the graphite act as catalytic nucleation sites for the formation of carbon nano tubes.

## **PROPERTIES OF NANO MATERIALS**

### **(i) Physical Properties**

- a) Interparticle spacing is very less in nano materials
- b) They have high strength and super hardness because it does not have any dislocation in it.
- c) The melting point of nano materials will be very less.

### **(ii) Electronic Properties**

- a) Energy bands in these materials will be very narrow.
- b) The ionization potential is very high for nano materials.
- c) They have more localized molecular bonds.

### **(iii) Magnetic Properties**

- a) The atoms will have less co-ordination number and hence possess local magnetic moment within themselves.
- b) They exhibit spontaneous magnetisation.
- c) Ferro – magnetic and anti - ferro magnetic multi layer nano materials has GMR (Giant Magneto Resistance) effect.