Synthesis of nanomaterials

- Top-Down Approaches: Involve the breaking down of bulk materials into nanosized structures. Example: Lithography, ball milling
- Bottom-Up Approaches: Involve assembling atoms or molecules to form nanostructures. Example: Chemical vapor deposition (CVD), sol-gel process.

Laser Ablation

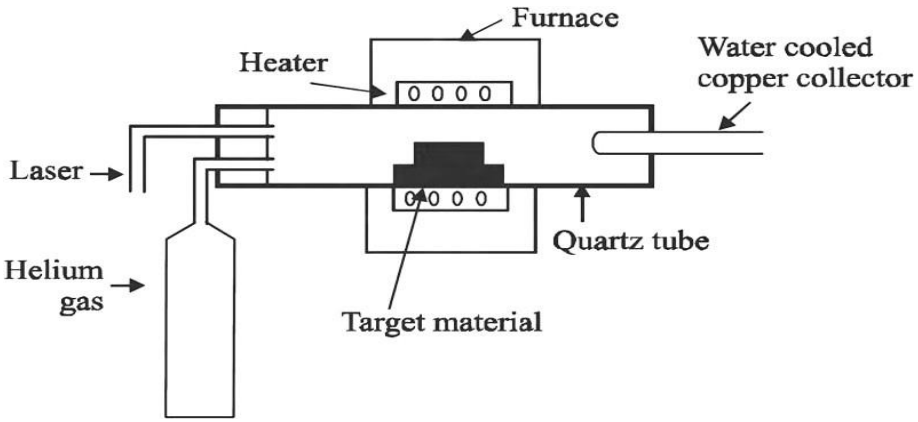
Laser ablation is a process of removing material from a solid surface by irradiating it with a laser beam

- In laser ablation, high-power laser pulse is used to evaporate the matter from the target.
- The stoichiometry of the material is preserved in the interaction.
- The total mass ablated from the target per laser pulse is referred to as theablation rate.

Reaction Setup

- This method involves vapourisation of target material containing small amount of catalyst (nickel or cobalt) by passing an intense pulsed laser beam at a higher temperature to about 120°C in a quartz tube reactor.
- When a beam of laser is allowed to irradiate the target, a supersonic jet of particles is evaporated from the target surface.
- Simultaneously, an inert gas such as argon, helium is allowed into the reactor tosweep the evaporated particles from the furnace zone to the colder collector.
- The ablated species condense on the substrate placed opposite to the target.
- The ablation process takes place in vacuum chamber, either in vacuum or in thepresence of some background gas.

A typical laser ablation setup in shown in the following figure.



Advantages**:**

- No solvent is used .Hence it is eco-friendly.
- It is easy to operate.
- The running cost is very low.
- Heating temperature of the target is minimum.

Uses

1. Nanotubes having a diameter of 10 to 20 nm and 100 um can be produced by this method.
2. Ceramic particles and coating can be produced.
3. Other materials like silicon, carbon can also be converted into nanoparticles by this method